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PAPERS

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OBSERVATIONS ON THE RECENT DISCOVERIES OF THE REMAINS OF THE MAUSOLEUM AT HALICARNASSUS.

By W. Tite, Fellow, M.P. Read at the Royal Institute of British Architects, Nov. 1, 1858.

After some introductory remarks Mr. Tite proceeded as follows. When the most ancient period of simple burial of the body had passed away, it was succeeded by those ages in which great and various efforts were made to distinguish or to adorn the resting-place of the deceased from motives of either honour or affection. In both cases, where the means existed of erecting an appropriate memorial, labour and expense were alike lavishly bestowed upon it. During the mythical period of history, when a nation honoured the grave of a departed hero, his surviving soldiers built up his monument by each one of them triumphantly depositing a stone upon the earth where he was laid, and rearing for him a lofty sepulchral mound. But in subsequent and more polished times, when death came as the separator of dear companions, the memorial erected frequently expressed the sorrowing love of the survivor. With the Hebrews, and also with the Arabians, tombs and burial-places were established localities for lamentation; * and sometimes their interiors were arranged as chambers for mourning. It is possible, therefore, that the *cella*, or small apartment under the pyramid, in the Tomb of Mausolus, was such a chamber, and might have been intended by Artemisia as a place wherein she could indulge even her grief in all the luxury of unrestrained sorrow.

The pathetic story of the Queen of Caria, and of the erection of her most famous monument, after having been for a considerable period regarded by many as little better than a very beautiful classical romance, has recently received a remarkable testimony to their truth, in the discovery of a large number of interesting remains of extensive buildings, marble sculptures, and antiquities, in the ruined edifices at *Boudroum*, a small Turkish village now standing on the site of the ancient Halicarnassus, the birth-place of Herodotus the Father of History. These researches were commenced a few years since at the expense of the British Government, under the personal superintendence of Mr. C. T. Newton, at that time Her Britannic Majesty's Consul at Mytilene. In the progress of these excavations, Mr. Newton has discovered a sufficient number of reliques to enable him with tolerable certainty to restore the whole building, and thus to confirm the accuracy of those statements which the ancient historians have transmitted to the present age.

The village of Boudroum is situated at the head of a bay of the same name, on the south coast of Asia-Minor, known to the ancients by the name of the Bay of Cos, or the *Sinus Ceramicus*. It made a conspicuous figure in the history of the great struggle between the East and the West, which took place during the middle ages; for the Knights of St. John of Jerusalem had there one of the most important of the fortresses, by means of which the Latin Christians endeavoured to maintain possession of Syria. But in times yet more ancient, the City of Halicarnassus seems to have been of still greater importance than it was during the period of the Crusades; for it was then the capital of a kingdom enjoying a species of *quasi* independence under the protection of the Persian Monarch, long after it had ceased to be perfectly free. That part of Asia-Minor was, at a very early historical period, invaded by one of the Dorian Colonies, and a distinct nationality was created by it under the name of *Caria*. A short time before Cyrus the Great established the supremacy of Persia in this region, Crœsus the Lydian seems to have overthrown the power of the Doric Tribes, and, in some degree, to have superimposed on the Doric civilisation the more elegant, and more effeminate, styles of Ionia.

* *John* xi. 31. "She goeth unto the grave to weep there."

At any rate Crœsus overcame the Doric Tribes which occupied the ancient Caria, to succumb, in his turn, before the prosperous invasion of the Persians. Cyrus, however, seems to have thought it safer to establish in the remote provinces of his Empire Dynasties of native Princes, directly responsible to himself, than to administer those provinces in the usual Persian style of Satrapies, or provincial governments. We thus find that a race of indigenous kings was established for the government of the province of Caria, subsequently to the overthrow of Crœsus by his great rival; and that they retained their power until the Macedonian conquest swept aside the whole of the governmental organisation of the Ionic Tribes, which it had suited the convenience of the Persians to retain during their short-lived Empire under Cyrus and his successors.

One of the most famous of these native Ionic Princes of Caria was Mausolus, the son of Hecatomnus, who married his own sister * Artemisia, and died without children about the year 353 B.C. Mausolus left his kingdom to his wife, and she endeavoured to console herself by the construction of that celebrated tomb, which was subsequently considered one of the wonders of the world, but which was not finished during her life. Artemisia, in fact, followed her husband to the grave within two years, leaving the kingdom to a brother of Mausolus; who, in his turn, left the throne of Caria to his wife Ada. The latter was driven from Halicarnassus by Pixodarus, the surviving brother of Mausolus, and Ada then sought the assistance of Alexander the Macedonian against her rival. Alexander assisted Ada, and besieged and took, after a vigorous resistance, the citadel of Halicarnassus: whereupon he reinstated Ada in the nominal sovereignty of Caria, but retained for himself and his successors the possession of the citadel, the most important military position. The Macedonian Princes of Syria, however, did not long respect the independence of Caria, for Antiochus the Great incorporated that kingdom with the rest of his possessions; and, subsequently, upon the first appearance of the Romans in Asia-Minor, Caria was divided between Eumenes, King of Pergamus, and the Rhodians; to be absorbed shortly afterwards into the Roman Empire. The Saracens overran this district very soon after their appearance upon the stage of the world; and, though the Knights of St. John for a time maintained themselves at Boudroum, even long subsequently to the destruction of the Latin kingdom of Jerusalem, the Turks, under Solyman the Great, succeeded in finally wresting from the Christians this last vestige of their power in the East, about the year 1522. As might be expected, the Tomb of Mausolus suffered greatly during all these different wars and sieges; but from certain passages in the Byzantine Historians Eudocia and Eustathius, it would appear to have remained in a tolerably perfect state so late as the Twelfth century. At some unknown subsequent period, its ruin appears to have been caused by an earthquake; but its final demolition was effected by the Knights of St. John, who pulled it down for the purpose of obtaining materials for the Castle of San Pietro, which they erected about the year 1404.

These are briefly the events that led to the erection, as well as to the destruction, of a Tomb which has become the most famous in all profane history. But, beyond this narrative, there is something exceedingly romantic and touching in the conduct of Artemisia in erecting, as she fondly believed, an eternal memorial to the memory of her husband, and it furnishes a remarkable contrast to the conduct of Margaret of Austria in more modern times. Artemisia mourned like one who "mourned without hope," and the memorial which she raised was therefore dedicated solely to the commemoration of him whom she had so deeply loved, and to her own sorrow. The Christian Princess, on the other hand, under a similar affliction, sought her consolation in the erection of a Church, for the service and glory of Him who is "the God of the *Living* and not of the *Dead!*"

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* Some analogy may be found in the following passage:—

"His daughter she:—in Saturn's reign,
Such mixture was not held a stain."—*Il Penseroso*, 25.

Without at all entering on the discussion of the relative merits of *Classical* and of *Gothic* Architecture, I cannot refrain from saying that the Church of Notre Dame de Brou, at Bourg-en-Bresse, erected by Margaret of Austria to the memory of her deceased husband, Philibert Emmanuel of Savoy, is as infinitely more beautiful as a mere monument, as the tone and character of her grief were more pure and holy than was the monument or the grief of Artemisia. It is, however, singularly remarkable, that the history of Artemisia, and the fame of the mausoleum which she erected, have gone forth to the ends of the earth; whilst those of the sacred edifice built by Margaret are, comparatively speaking, almost unknown: so capricious is History! so false, in many instances, is the appreciation of the world!

I said that there is something touching about the story of Artemisia's grief; and, indeed, after allowing much for the exaggeration of poets and historians, and for the peculiar circumstances of her times and position, the term used can hardly be considered exaggerated. The body of Mausolus was *burned* in accordance with the usual custom of the *Ionians;* for it is to be observed that the *Dorians*, and, generally, all the ancient Greeks, *interred the bodies of the deceased;* and that the practice of burning the dead prevailed only in the later periods of the Hellenic civilisation. The ashes of Mausolus were then carefully collected; but as Aulus Gellius is the accepted, as well as the most copious, authority for this ancient anecdote, I will give it as the passage is rendered by the Rev. William Beloe, in his version of the Attic Nights. "Artemisia is related to have loved her husband Mausolus beyond all the stories of amorous affection; nay, beyond the limits of human attachment. When this Mausolus died, and was entombed with a magnificent funeral, amidst the tears and lamentations of his wife; Artemisia, inflamed with grief and sorrow for the loss of her husband, had his bones and ashes mixed with spices, reduced to powder, and then drank them infused in water."*

In the same passage Cicero is referred to as the authority for considering Mausolus as the King of Caria. The passage occurs in his *Tusculan Questions;* and though it is very short, and the notice of Artemisia and her Mausoleum is only incidental, it is still very valuable as proving how popular was her story, and how widely known was the edifice three centuries after the time to which they belonged. The mortal grief of Artemisia is cited by Cicero as an illustration of the lasting nature of "*recent evil*," according to the real meaning of Zeno; being not that only which has occurred lately, but that which retains any force, vigour, or freshness; for so long is it entitled to the name of recent. "As that Artemisia," continues Cicero, "the wife of Mausolus, King of Caria, who made the noble Tomb

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* The whole passage is as follows: "Artemisia Mausolum virum amasse fertur supra omnis amorum fabulas, ultraque affectionis humanæ fidem. Mausolus autem fuit, ut M. Tullius ait, rex terræ Cariæ; ut quidam Græcarum historiarum scriptores, provinciæ Græciæ præfectus. *Satrapen* Græci vocant. Is Mausolus ubi fato perfunctus inter lamenta et manus uxoris funere magnifico sepultus est; Artemisia luctu atque desiderio mariti flagrans uxor ossa cineremque ejus mixta odoribus contusaque in faciem pulveris aquæ indidit, ebibitque: multaque alia violenti amoris indicia fecisse dicitur. Molita quoque est ingenti impetu operis, conservandæ mariti memoriæ, sepulcrum illud memoratissimum, dignatumque numerari inter septem omnium terrarum spectacula. Id Monumentum Artemisia quum Dis Manibus Mausoli dicaret; Ἀγῶνα (id est *Certamen*) laudibus ejus dicundis, facit; ponitque præmia pecuniæ aliarumque rerum bonarum amplissima. Ad eas laudes decertandas venisse dicuntur viri nobiles ingenio atque lingua præstabili Theopompus, Theodectes, Naucrites. Sunt etiam qui Isocratem ipsum cum iis certavisse memoriæ mandaverint: sed eo certamine vicisse Theopompum judicatum est. Is fuit Isocratis discipulus. Extat nunc quoque Theodecti Tragœdia, quæ inscribitur, Mausolus: in qua eum magis quam in prosa placuisse Higinus in exemplis refert." *Noct. Attic. lib.* x. *cap.* xviii.

Valerius Maximus is another ancient Author who has recorded the sorrow of Artemisia in his collection of *Memorable Acts and Sayings*, in the following passage: "Gentis Cariæ regina Artemisia virum suum Mausolum fato absumptum quantopere desiderarit, leve est, post conquisitorum omnis generis honorum, Monimentum usque ad Septem Miracula provecti magnificentiam, argumentari. Quid enim aut eos colligas, aut de illo inclyto tumulo loquare, cum ipsa Mausoli vivum ac spirans sepulcrum fieri concupierit, eorum testimonio, qui illam extincti ossa potioni aspersa bibisse tradunt." *De Factis Dictisque Memorab. lib.* iv. *cap.* vi. *Externa I.*

at Halicarnassus,—whilst she lived she lived in grief, and died from the same cause, being worn out by it; hence this sentiment of sorrow was with her always recent." Strabo also notices the excessive grief of Artemisia, and considers that it brought on *phthisis*, of which she died. He probably derived his information from the Prize-Tragedy of "*Mausolus*," written by Theopompus, which was extant in his time, and which is quoted for the fact by Harpocration in his Lexicon.*

From the romantic story of the Founder of the Tomb of Mausolus we pass to those ancient descriptions of the Sepulchre itself, by which we are enabled to identify it, even from its ruins, and more than conjecturally to restore the original appearance of the edifice. In this part of my illustrations, I have gladly availed myself of the elaborate and interesting series of authorities relating to it contained in an erudite paper by Mr. Charles Newton, M.A., "*On the Sculptures from the Mausoleum at Halicarnassus*," printed in 1847, in *The Classical Museum*.† He very properly commences by considering so much of the topography of the ancient city described by Vitruvius, in the eighth chapter of his second Book, as determines the actual site of the monument.‡

The most valuable ancient description of the monument itself, which is now extant, is that given by Pliny in his Natural History, on which, as Mr. Falkener properly observes, are founded the various theories that have been proposed for the restoration of the monument. In this passage Pliny is treating of the finest specimens of sculpture in marble, and the most excellent of the artists who were employed on them; and this leads him to enumerate those who executed the figures on the monument at Halicarnassus, and then to describe the building itself. I will give his account in the diffuse, though very characteristic, translation of Philemon Holland.

"To returne againe unto Scopas: he had concurrents in his time, and those that thought themselves as good workemen as himselfe, to wit, Bryaxis, Timotheus, and Leochares; of whome I must write joyntly together; because they joyned all foure in the graving and cutting of the stately monument MAUSOLEUM. This Mausoleum was the renowned tombe or sepulchre of Mausolus, a pettie king of Caria, which the worthie ladie Artemisia, sometime his queene and now his widow,—caused to be erected for the said prince her husband, who died in the second yeare of the hundredth Olympias: and verely so sumptuous a thing it was, and so curiously wrought by these artificers especially, that it is reckoned one of those matchlesse monuments which are called "the Seven Wonders of the World." From North to South it carrieth in length sixtie-three foot: and the two fronts East and West make the breadth, which is not at all so large; so as the whole circuit about may contain foure hundred and eleven foot. It is raised in height five and twentie cubits, and environed with six and thirtie columns. On the East side Scopas did cut; Bryaxis chose the North end; that side which regardeth the South fell to Timotheus; and Leochares engraved at the West end. But the Queen Artemisia—who caused this rich sepulchre to bee made for the honour and in the memoriall of her husband late deceased,—happened herselfe to depart this life before it was fully finished. Howbeit, these noble artificers,

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* *Strabonis Rerum Geographia*, lib. xiv. sect. xii.; *Harpocrationis Lexicon Decem Oratorum*, sub voce Ἀρτεμίσια. The words of this Lexicographer are Ἦν φησὶ Θεόπομπος φθινάδι νόσῳ ληφθεισαν.

† Volume V, Art. ix. p. 170-201.

‡ "Cum enim—animadvertisset Halicarnasso locum naturaliter esse munitum, emporiumque idoneum, portum utilem, ibi sibi domum constituit. Is autem locus est theatri curvaturæ similis. Itaque in imo, secundum portum, forum est constitutum; per mediam autem altitudinis curvaturam præcinctionemque platea ampla latitudine facta. *In qua media Mausoleum ita egregiis operibus est factum*, ut in Septem Spectaculis nominetur."—*De Architectura*, lib. ii. cap. viii, 37, 38.

"Namque singulis frontibus," says Vitruvius, in another place, "singuli artifices sumpserunt certatim partes ad ornandum et probandum, Leochares, Bryaxes, Scopas, Praxiteles, nonnulli etiam putant Timotheum; quorum artis eminens excellentia coegit ad Septem Spectaculorum ejus operis pervenire famam."—*Idem.* lib. vii. præfat. sect. 8.

whom shee had set a-worke,*—would not give over when shee was dead and gone, but followed on still and brought it to a finall end; as making this account:—that it would be a glorious monument to all posteritie, both of themselves and also of their cunning: and in truth at this day it is hard to judge by their handy-worke who did best. There was a fifth workeman also came in unto them; for, above the side wall or wing of the tombe, there was a pyramis founded, which, from the veric battlements of the said wall was carried to the heighth of the building underneath it. The same grew smaller still as the worke arose higher; and from that heighth, at everie degree (step), which, in the whole were foure-and-twentie, was narrowed and taken in; until at last it ended in a pointed broche: in the top whereof there is pitched a coach with foure horses, wrought curiously in marble; and this was the worke of Pythis for his part. So that reckoning the chariot with the sharpe spire; the pyramis under it unto the battlements; and the bodie of the sepulchre founded upon the firme ground;—the whole worke arose to an hundred and fortie foot in heighth.†

Notwithstanding all the difficulties and discrepancies which both Architects and Commentators have found in the preceding passage, it still continues to be the most explicit and copious description extant of the Tomb of Mausolus. There remain besides only some short and scattered, though interesting notices of it, in the later ages previous to its destruction; and one of these has been happily produced by Mr. Falkener as appearing to remove a great difficulty in the description of Pliny. "Some time," says he, "after having completed this plan I discovered the following passage in Hyginus, which had hitherto escaped the attention of commentators:—'Monimentum regis Mausoli, lapidibus lychnicis altum pedes LXXX. Circuitus pedes MCCCXL.'—Fabulæ, ccxxiii. This dimension of 1340 feet will be found to coincide very precisely with what I had conceived to be the best proportion for a peribolus to enclose the tomb itself and the funeral pile, the longest side of which was 411 feet. I therefore regard it as determined that the tomb itself was furnished with a peribolus, and that it measured 411 feet by 259 feet." Mr. Falkener proceeds to suppose it possible, that the words of Vitruvius respecting the site of the monument, "*platea ampla latitudine facta*," might really refer to the peribolus or enclosure.‡

The notice of this monument given by Pausanias consists only of a general praise of its very stately appearance. After having mentioned the Mound of Æpytus, celebrated by Homer, he says, "I know of many admirable tombs, but I will content myself with noticing two; one at Halicarnassus, and the other in the country of the Hebrews. That which is to be seen at Halicarnassus was erected for Mausolus, King of the Halicarnassians; and is so wonderful both for its grandeur and its magnificence, that the Romans, filled with admiration for the monument, have given the name of Mausoleum to all remarkable tombs."‖

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* "And he"—Solomon—"set three thousand and six hundred overseers, to set the people a-work."—*II. Chron.* ii. 18.

† "*Scopas* habuit æmulos eadem ætate, *Bryaxin*, et *Timotheum*, et *Leocharem*; de quibus simul dicendum est, quoniam pariter cælavere, MAUSOLO Cariæ regulo, qui obiit Olympiadis CVI. anno secundo. Opus id ut esset inter Septem Miracula ii maximè artifices fecere. Patet ab Austro et Septentrione, sexagenos-ternos pedes; brevius a frontibus: toto circuitu pedes quadringentos undecim: attollitur in altitudinem viginti-quinque cubitis: cingitur columnis triginta-sex. *Pteron* vocavere. Ab Oriente cælavit *Scopas*, a Septentrione *Bryaxis*, a Meridie *Timotheus*, ab Occasu *Leochares*. Priusque quam peragerent, Regina Artemisia, quæ mariti memoriæ id opus exstrui jusserat, obiit. Non tamen recesserunt, nisi absoluto jam, id gloriæ ipsorum artisque monumentum judicantes: hodieque certant manus. Accessit et quintus artifex. Namque supra Pteron pyramis altitudine inferiorem æquavit, viginti-quatuor gradibus in metæ cacumen se contrahens. In summo est quadriga marmorea, quam fecit *Pythis*. Hæc adjecta centum quadraginta pedum altitudine totum opus includit."—*Hist. Nat.* lib. xxxvi. cap. v. sect. 9.

‡ "*On the Mausoleum, or Sepulchre of Mausolus at Halicarnassus.*" By Edward Falkener, Esq., *Museum of Classical Antiquities*, vol. I. 1851, art. xv. pages 157-189.

‖ *Ελλαδος Περιήγησις. Ἀρκαδικα (VIII.) xvi.

In the Epigram *De Spectaculis*, which is attributed to Martial, written to commemorate the Inauguration of the Amphitheatre of Titus, when the poet is referring to the past glories of the Pyramids and the Temple of Diana, he notices the lofty lightness of these sepulchres; and predicts that even the Mausolea, which seem to be suspended in the empty air, and had been lauded to the very stars by the boasting Carians, should lose their renown in the fame of the edifice of Cæsar.*

The speakers in the Twenty-fourth of Lucian's Conferences of the Dead are Mausolus and Diogenes, whose Dialogue incidentally supplies some few curious particulars of this Tomb. When the Philosopher enquires why the Carian Prince assumes so much importance, he concludes his reply by saying "the principal reason is, that I have a prodigious monument raised over me at Halicarnassus, which for magnitude and beauty has not its equal in the whole world; and is decorated with the most exquisite figures of men and horses, all carved to such a degree of perfection, and in such exceeding fine marble, as you will not easily find even in a temple."

Having given these Classical authorities, Mr. Newton proceeds in his paper to remark that there are other "ancient writers, from time to time alluding to the Mausoleum as one of the Seven Wonders of the World, and as still existing. It is thus noticed in the second century by Pausanias; in the latter end of the fourth by Gregory of Nazianzus; by Constantine Porphyrogenitus in the tenth; by Eudocia, in the eleventh, who must have been misinformed as to its site, for she describes it as built on a mound in a marshy lake; and again in the twelfth century by Eustathius, who speaks of it as still existing Θαυμα και ἦν και εστι—It was and is a Wonder." Mr. Newton adds also a very interesting narrative of the discovery and spoliation of the tomb in 1522, when the Turks attacked Rhodes under Solyman II. and the Grand Master of the Knights repaired the Castle of San Pietro with the stones of the edifice, which they found in searching for materials, on the site of the great square of Halicarnassus. In this narrative we are informed, that one day after dinner the soldiers came to an opening like the entrance to a cave; and that on going into it with a light, they found a large and handsome square chamber, decorated on all sides with marble columns enriched with bases, capitals and architraves, and having their friezes and cornices sculptured with histories in basso-relievo, with which also the walls were ornamented. After having admired the apartment, and exercised their conjectures concerning it, they began to demolish it, breaking it down to supply materials for that which they had to build. Beyond this chamber they came to a very low door leading into an anteroom, in which was a sepulchre, with a vase and a closed cover of white marble, very fine and wonderfully lustrous. The retreat being then sounded, the knights had not time to open them; and on their returning the next day they found that the tomb had been discovered and rifled by others; and the ground strewed with small fragments of cloth of gold and little studs of rich metal. They concluded thence that the Corsairs, who abound all along that coast, had likewise found out the building, and having entered it during the night, had broken open the sepulchre and carried away all the treasures contained in it. "Thus," says Claude Guichard, in closing his narrative, "was this superb tomb,—accounted as one of the Seven Miracles and marvellous works of the world,—after having escaped the fury of barbarians, and having existed entire for the space of 2,247 (1875?) years,—though buried in the ruins of the city of Halicarnassus;—thus was it discovered and destroyed by the cross-wearing Knights of Rhodes to re-edify the Castle of San Pietro.† Having now completed the attempt to illustrate the original erection and the destruction of the Tomb of Mausolus, I proceed to give some account of the

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* "Aëre nec vacuo pendentia Mausolea
Laudibus immodicis Cares in astra ferant:"—

† *Funerailles et diverses Manières d'Ensévelir des Romains, Grecs, &c.* Lyon, 1581, 4to. lib. iii. c. 5, p. 378-381.

late re-discovery of its ruins; by which another great testimony to the truth of Ancient History has been happily redeemed from the past.

At the commencement of the present century, both the educated and the uneducated inhabitants of Western Europe had alike forgotten the memory of a highly developed state of civilisation in Asia Minor, antecedent to that of the brightest period of the Greek, or any portion of the Roman, history; and the existence of even the ruins of the great cities of that region was hardly suspected by the scholiasts or the commentators on the most ancient treatises on the History of Art. The well-known passages in Pliny and in Vitruvius had indeed given rise to much debate amongst the more learned Authors of the Sixteenth and Seventeenth centuries; but they contented themselves with abstract and theoretical disquisitions; nor perhaps, in the then disturbed state of the East, was it likely that a mere love of Antiquity would induce any one to encounter the dangers of a personal investigation of the scene which had witnessed such "strange eventful histories." In 1793 Sylvestre De Sacy published a work on the Medals of the Sassanaid Kings of Persia, including also the Ruined Cities of Asia-Minor; and Mr. Moritt visited the very Ruins of Budrum, and appears to have written of them in glowing terms in the Journal which he gave to Dr. Edward Daniel Clarke, by whom several extracts were given in the second volume of his Travels, published in 1812.* In 1811 Capt. Beaufort contributed some valuable information to The Dilettanti Society on the Antiquities of Asia-Minor; and from that period the number of labourers in the same field has rapidly increased. Messrs. Cockerell, Donaldson, Texier, Flandrin, Coste, and, finally, Sir Charles Fellows, have of late years successively brought to light the reliques of the Extinct Nations of this region, and revived the interest in their history. The very remarkable discoveries of the gentleman last named excited, indeed, so much attention at the time of their publication, that it was felt to be desirable immediately to continue the operations which had led to those discoveries being made. This Institute, and The Architectural Society, of which I had at that time the honour to be President, sent deputations to Lord Palmerston, then Secretary of State for Foreign Affairs, for the purpose of impressing upon him the importance of obtaining the existing Sculptures at Halicarnassus, and of bringing them to England. This took place in 1841; and subsequently the work of excavation was begun under the directions of Mr. Newton and Captain Spratt: until at length, in 1857, the Fragments of Sculpture now arranged in the British Museum as "THE BUDRUM MARBLES," were shipped for England.

The operations, carried on under the personal superintendence of Mr. Newton, have produced some curious illustrations of the danger of following the interpretations of ancient texts made by closet-commentators. The actual site of the Mausoleum, which has been thus laid open, is not in accordance with any of the theories hitherto propounded in illustration of the passages of Strabo, Pliny, or Vitruvius; and the various ground-plots of the building, which have been suggested by the learned and ingenious travellers who preceded Mr. Newton, differ so remarkably from the *real plan* of the edifice, that I have had them drawn, for the express purpose of shewing how easy it is for the most able men to be mistaken in their interpretation of a mere verbal description. I am happy, however, to exempt from this remark the marvellous Restorations of my friend, Professor Cockerell. By his kindness I am able to introduce for inspection his very beautiful Drawing, exhibited during the last season at the Royal Academy; which is certainly a work of the highest Art and Intelligence. But, the result of Mr. Newton's excavations has been of far greater importance to the History of Art, than merely thus teaching to the learned a lesson of modesty; as he has discovered the area, or platform, on which the Mausoleum was built. He has found also a sufficient number of reliques to enable him to restore the whole building with tolerable certainty, and thus really to confirm the accuracy of the accounts handed down to us by the Ancients. Many of the most characteristic

* Travels in various Countries of Europe, Asia and Africa, part II, Lond. 1812, 4to. p. 214, note 2.

specimens of the Sculpture, and of the Architectural details of this Monument, have been sent to this country; together with some Fragments bearing Inscriptions, Terra-cotta Figures, Lamps, Tesselated Pavements, etc. of other periods in the history of Halicarnassus.

Turning now to the consideration of the Mausoleum itself, as we are able to assert that it existed, our first observation is, that the very style of its Architecture bears witness to one of the great revolutions which had passed over the country where it was erected. The style, and even the order adopted, were Ionic, and no traces of the Dorian element of Caria are to be discovered in it; whilst the existence of a complicated series of galleries and subterranean chambers beyond the platform of the Monument itself, recalls the system of interment which seems to have prevailed amongst the Pelasgic predecessors of both Dorians and Ionians, if we may class the Nuraggis of the Island of Sardinia, and the Tombs of ancient Etruria, amongst the reliques of that remarkable race.

There is not, however, the same amount of certainty with respect to the manner in which the pyramid was supported, which appears to exist with respect to the general character of the Mausoleum; but Messrs. Newton and Smith's excavations have so closely confirmed the most important parts of Vitruvius and Pliny's descriptions of this monument, as to justify them in the restoration of the parts still wanting from the remainder of those descriptions. The utter overthrow and the dispersion of the materials of the tomb have, indeed, rendered it impossible for us to discover, beyond dispute, what the design originally was. But the fragments are so numerous and characteristic, the accounts handed down to us from antiquity are so clear, and the analogy of other sepulchral monuments of the same date leaves so little room to doubt the correctness of Messrs. Newton and Smith's suppositions, that it may fairly be said that those gentlemen have satisfactorily set at rest the discussion as to the general outline of the building, as they unquestionably have done with respect to its position.

The Mausoleum then may be described as having been erected upon a platform, partly excavated in the natural rock, and partly consisting of artificial construction, about 126 feet long by 107 feet broad. On this was raised, in the style of the monumental sepulchres of the antients, a lofty base, similar to those of the very remarkable Xanthian Tombs also in the British Museum, or to those of the celebrated Tombs of Constantina in Algeria, or of Ooran in Phrygia, given by Mr. Falkener in his learned paper. This base was in all probability ornamented with sculptured friezes, as in the case of the Xanthian Tombs: for a great number of slabs, sculptured in bas-relief, and occasionally bearing fragments of mouldings, have been discovered. A curious passage in Pliny may be mentioned referring to this use of marble slabs. He says, "I am not sure whether the art of cutting marble into slabs be not an invention for which we are indebted to the inhabitants of Caria. The most ancient instance of this practice, so far as I know, is to be found in the Palace of Mausolus at Halicarnassus; the walls of which are of brick covered with marble of Proconnesus." Thus there is nothing new under the sun, and the questionable sham of marble facings to brick buildings has not even the merit of novelty.* However, there seems little reason to doubt that the four celebrated sculptors already mentioned, Bryaxis, Timotheus, Leochares, and Scopas, were employed respectively to carve the friezes of this portion of the building; and it is to be observed that there is a sufficient difference in the scale of some of the figures, and in their mode of treatment, to warrant the supposition of their having been the productions of different artists. From the fragments now placed in the British Museum it would appear that these sculptures represented the favorite subject of an Amazonomachia; but it is hardly possible to conjecture the connection between the battles of the Amazons and the history of Mausolus.

The square base of the monument was, no doubt, crowned by an ornamental cornice, according

* See Vitruvius, lib. ii. cap. viii, 37.

to the restoration of Messrs. Newton and Smith; and upon this was a stylobate or plinth on which the columns rested, measuring about 114 feet by 92 feet. There was then erected a single row of columns of the Ionic order, thirty-six in number, placed so as to present the somewhat singular arrangement of an uneven number of columns on two of the faces of the monument. The columns were of the Ionic Order, and, according to Pliny's account, the height of the whole Order was 37½ feet; the diameter of the columns, as ascertained from the actual remains, was 3 feet 5 inches, and the space between them seems to have been about 7 feet 4 inches: proportions, which it may be as well to observe, by way of confirmation of the restoration, are the same as those followed in the Temple of Minerva at Priene, built by the architect who is supposed to have been engaged on the Mausoleum. Above the cornice of these columns was placed a pyramid of marble steps, put together with great skill, as we may perceive by the enlarged drawing on the wall. There were twenty-four of these steps, the lowest of which measured on the edges 108 feet by 86 feet; and as the rise of each step was 11½ inches, and the width of the tread respectively 1 foot 9 inches and 1 foot 5 inches, a platform was left at the top of about 24 feet by 18 to receive the colossal group which crowned the whole monument. This group is said to have been the work of Pythis, and to have represented Mausolus, and perhaps Artemisia, in a quadriga, or four-horse car. In the excavations near this tomb there were discovered some reliques of other colossal statues, but I am not able to discover the precise positions which they occupied in the building.

The details of the capitals, and of the other ornamental parts of the architecture of this Monument, do not certainly seem to bear the same stamp of elegance which may be observed in the buildings of Attica, or of Ionia, erected about the time of Pericles; though they were still superior to those of the buildings of Asia-Minor erected in subsequent ages. The same remark may be made with respect to the sculpture; the colossal figures, especially, seem to have been characterised by the pains lavished upon the execution of the drapery, and the bassi-rilievi by the violent movements, and by the mixture of different coloured materials, which prevailed when the Arts had lost the severe grandeur of the best epoch. There is, indeed nearly as much of barbaric pomp as there is of Grecian refinement in this Mausoleum.* One of the fragments of sculpture now in the British Museum merits, however, rather more than the casual notice which I have given of the rest. I allude to the colossal statue supposed to represent Mausolus himself, which has been reconstructed under the superintendence of Mr. Edward Hawkins, Keeper of the Antiquities, from more than fifty pieces.

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* It has been received almost as an indisputable fact, that even Phidias himself was addicted to the vicious practice of his age in painting his sculpture. Without attempting to enquire into the principles on which this was done by the Greeks who flourished between the fifth and the second centuries B.C.,—it may very fairly be questioned whether that unrivalled sculptor did not rather restrain the use of colour, among those important revolutions which he effected for the purity and improvement of his art. For further satisfaction on this subject, and not less for gratification, I must refer to the very careful and excellent Paper "*On Colouring Statues*," written by Richard Westmacott, Jun., Esq., R.A., in 1854, and contained in *The Archæological Journal*. Mr. Westmacott therein considers, that Phidias "had the genius, and his favour with Pericles gave him the power, to break through much that was prescriptive and traditional in sculpture:"—but that those liberties and innovations which he "suggested and effected in the general treatment of historical and poetical subjects, would not be permitted in the same degree in the representation of sacred personages." In obedience, therefore, to the universal feeling, Phidias made the statues of Jupiter at Elis, and of Minerva at Athens, out of various materials; for those works were the offerings of a grateful people for the most important victories achieved over a powerful enemy; and were to be constructed out of the spoil taken from the vanquished foe: thus ivory and gold, painting and inlaying, and every conceivable enrichment were lavishly bestowed to make those votive statues the most costly of dedicated gifts. From these considerations, it appears to me, that Phidias stands rather in the situation of Domenico Ghirlandajo, and some other artists who flourished at the end of the fifteenth century; who endeavoured to abolish the use of gilding in pictures, and to establish genuine painting in the place of illuminating.

I may, however, describe it most characteristically by quoting the words of that able and enthusiastic Antiquary: "In this figure, executed about B.C. 350, we have probably the most ancient example of Greek portrait statuary which has as yet been discovered. Nor is its merit as a work of art inferior to its interest as an historical monument; for whether we regard the grandeur and simplicity of the conception, the admirable composition of the drapery, or the skilful combination of the ideal with the individual in the treatment of the features, it is equally deserving of the admiration of every student of sculpture." To this description I have to add only that it bears too evident signs of having been painted.

It is probable that these colossal statues were placed in or about the *cella*, or the small temple under the pyramid; which *cella* seems to have served as a kind of chapel. It was, according to Messrs. Newton and Smith, about 63 feet long by 41 wide, and constructed of polished marble. The Knights of St. John do not appear to have respected either the monument or its ruins; for they actually resorted to it as a quarry, and employed the materials in building their temporary stronghold. In some instances this was a fortunate spoilation, for they turned the sculptured faces of the friezes inwards, and so protected them from the weather and the destructive hands of the Turks; but the whole proceeding does little honour either to the taste or to the education of those military monks.

I have stated that besides the remains of the sepulchre of Mausolus, a large collection of interesting antiquities was found in the excavations, and has been safely transported to England. The best account of these reliques is contained in the very valuable memorandum describing them, drawn up by Mr. Hawkins, Keeper of the Antiquities in the British Museum, as a Report addressed to the Trustees, and laid before both Houses of Parliament by command of Her Majesty. In that paper the collection is stated to comprise Four principal classes of Antiquities, consisting of:—1. Remains of the Sculptures which formerly decorated the Tomb of Mausolus. 2. A miscellaneous assortment of Architectural Fragments, no doubt belonging to the same celebrated edifice. 3. A number of Fragments, bearing Greek Inscriptions and Names, for the most part the handles of *diotæ* for containing wine. 4. Portions of several Mosaic Pavements, procured from the sites of villas in the neighbourhood of the Mausoleum, and nearly all of Roman times.

To the lovers of art, and the investigators of antiquity, the first impression which these reliques convey is that of indignant regret, that time and wanton destruction have left us so little of so stately and interesting an edifice; as that feeling is expressed in the impassioned verses of Byron.

"There is a temple in ruin stands,
Fashion'd by long-forgotten hands;
Two or three columns, and many a stone,
Marble and granite with grass o'ergrown.
Out upon time! it will leave no more
Of the things to come than the things before.
Out upon time! who for ever will leave
But enough of the past for the future to grieve
O'er that which hath been, and that which must be:
What we have seen our sons shall see,
Remnants of things that have pass'd away,
Fragments of stone rear'd by creatures of clay." *

But these remains contain within them other lessons also; and, if they are read aright, they will teach us that man's greatest works are all perishable; that *Words* are often more durable than *Things;* that peoples and empires pass away without "leaving even a wrack behind;" that wealth, civilisation, and political grandeur at one period, are no guarantee of even national existence at others; and that

* We regret that our limits compel us to compress somewhat this important Paper.

the merits of kings or rulers cannot uphold nations which are themselves devoid of moral worth. May we take these lessons to ourselves! and let us hope, that *when the imagined New Zealander may come here to seek, in the cradle of his race, for Antiquities wherewith to adorn the Museums of the Southern Hemisphere, to be erected Two Thousand Years hence*, he may find not only traces as noble and as beautiful of the best private affections amongst *our* Rulers, as those observable in the Marbles of Budrum, but also *that which has not been hitherto discovered* in Greece, Asia-Minor, or Egypt (with the exception of the buried cities in Italy) traces of the individual worth, energy, and moral power, of the private citizens of our land! Sooner or later the Empire must pass away from us; and it seems to me, whilst musing on the fate of this Mausoleum, that it behoves us seriously to enquire whether we as a nation are leaving our impress on the records of Time for Good—or for Evil.

Mr. Westmacott, R.A. Visitor, described the colossal statue of Mausolus, which had been broken into no less than 67 fragments, as a very extraordinary work in an artistic point of view, especially in the treatment of the drapery, which was also excellent in the female figure. Mr. Hawkins had expressed an opinion that these sculptures were originally painted; but after looking carefully into the matter he could not find any decided traces that such was the case. There was a red tint on the under part of one of the horses, but that might be produced by oxide of iron, or from some other cause. He had tried hard to discover whether any blue had been used in the ground of the bassi-rilievi (as he believed was the case in the Parthenon), but he could not trace any, and there was no sufficient body of colour in any part to support the view that the marbles had been painted. In equestrian statues generally, the Greek sculptors, who invariably acted on principle and not from caprice, represented their horses in action; and the principle was a sound one, because the body of a horse with a man upon it was in the whole a heavy and cumbrous mass, and to place two such masses upon four straight columns would evince great poverty of invention. A horse should never be made to look like a biped, as it must if represented at rest, when viewed in certain positions. The Greeks therefore carefully introduced a great variety of lines in their equestrian statues. Among the remains brought from Halicarnassus were portions of the trunks of two horses, to which the Trustees of the British Museum had requested him to put legs; in doing this he found from the anatomical construction of the trunks that one, if not both, of the horses was certainly in a standing posture, and considering the peculiar nature of the monument on which this quadriga was placed, a departure from the ordinary practice might in this case be fully justified.

Mr. Cockerell, Fellow, said he could have wished that Mr. Tite had expressed a more decided opinion on the different competitive restorations, or submitted a design of his own. The essay of Mr. Newton, to which Mr. Tite had referred, was illustrated by a small sketch made by himself, and he believed that solely by the line and the two-foot rule he could show some authority for the whole of his restoration. In the first place, as the diameter of the column was fixed, the height of it was determined, as well as the proportions of the architrave, the frieze and the cornice. The cornice was also found, and the divisions between the lions' heads on it determined the intercolumns; so that unless it was to be taken as one diameter more, the intercolumniation was fixed as he had adopted it; these were important data which they could not disregard. Thirteen fragments of lions had been discovered, but all so disintegrated in parts that it was evident they must have been placed in some very exposed position. With regard to the steps, he thought Mr. Newton had been misled by the passages which had been quoted; he apprehended that the steps formed a steep incline from the attic order over the entablature up to the platform on which the quadriga and horses stood, and were so arranged in order that the horses' feet might be seen from

below. With regard to the Pelasgic arch, with horizontal courses, as a mode of spanning the space of 22 feet between the single row of columns and the cella shewn on Mr. Newton's plan and section, he believed that scheme to be altogether impossible. Though Mr. Newton stated that no traces of a second row of columns could be found, such a grove of them was well calculated to sustain the pyramidal structure, and to allow the introduction of stairs leading to the summit, as shewn in his, Mr. Cockerell's, restoration of the Mausoleum.* The fragments now on their way to England would undoubtedly supply much additional information, and he would therefore reserve any further remarks till they arrived.

Mr. Vaux, Visitor, was of opinion that the monument had been ruined by an earthquake about the second or third century. It appeared from the account of Mr. Newton and others, that the principal relics of the colossal horse, and some of the larger specimens, must have been buried at a very early period, and that they had been hidden from view by the silt or washings from the mountain. He also thought that the materials which the knights removed to build their castle were nothing more than the solid parts of the structure on which the quadriga stood.

Mr. Tite said that the knights fortunately placed most of the sculptured faces of the friezes inside, when they used the materials of the tomb in building the castle; but some were built into the walls with the sculptures exposed, and it was the discovery of these friezes which, (after they had been obtained, in 1845) ultimately led to the English government sending Mr. Newton to bring the Budrum marbles to this country.

The Rev. R. Burgess, Hon. Member, mentioned some further particulars respecting the life and avaricious conduct of Mausolus.

Mr. M. D. Wyatt, Hon. Sec., agreed with Mr. Westmacott that this monument had not been painted; as he had sought in vain in the hollow parts and corners of the mouldings, in which traces of colour, or at least of the mordaunts employed, would most likely be found. He thought there was much beauty as well as artistic propriety in the quiet attitude of the horses. That they were not shewn in action was further proved by the drapery of the portrait statues of Mausolus and Artemisia, which was arranged in straight lines; whereas, if the horses had been seen as in rapid progression, the drapery of the figures in the car would also have been arranged in moving lines. He considered the statue of Mausolus one of the most dignified portrait statues he had ever seen.

Mr. Ashpitel, Fellow, made several objections to Mr. Newton's restoration, which he contended was not in accordance with the description of Pliny, nor structurally substantial. He regretted that an architect and a sculptor had not been sent to conduct the explorations.

A Vote of Thanks to Mr. Tite, was carried by acclamation, and the meeting adjourned.

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* In Mr. Cockerell's plan, the Mausoleum is arranged as a dipteral temple, viz.: with two rows of isolated columns all round the cella, there being thirty-six columns in all; six in each row in the front and rear, and seven in those on the two flanks, with a narrow cella opposite to the two middle columns in the front and rear, and to the three middle columns in the flank elevations.

SOME REMARKS ON THE CONTENTS OF THE ALBUM OF VILLARD DE HONNECOURT.

By H. B. Garling, Fellow. Read at the Royal Institute of British Architects, Nov. 15, 1858.

If anything might be expected to prove interesting and instructive to architects of the Nineteenth Century, occupied constantly in the attempt to instil new vigour into their art, by investigating the principles by which it was regulated at a period when it was practised under healthier and happier influences; it must be some document which should throw light on the professional character, the method and objects of study, the feelings and the habits of thought of those artists who fixed those principles and decided their expression, but of whom individually we know nothing beyond that which is afforded by the reflection of their mind exhibited in their works. Such a document is the Album of Villard de Honnecourt, the contents of which I propose to sketch briefly this evening, and which, although they may not satisfy all the curiosity we feel, nor convey much instruction to those before whom information must be laid in its most obviously practical and tangible form, will yet be found replete with interest, and suggestive of abundant matter for speculation.

The history of the manuscript is told in a few words: It was originally discovered in the Library of St. Germain des Près, and subsequently transferred, on the confiscation of ecclesiastical property, to the National Library. It consists of thirty-three sheets of parchment, about three-fifths of the original manuscript, which consisted of fifty-two. As, however, some interesting particulars of its condition and general character appeared in the "Builder" of last week, from the able pen of Mr. Burges, I need not dwell further on this part of the subject.

The manuscript was first noticed by Willemin in his Monuments Français inédits. Later, in 1849, Monsr. Jules Quicherat, Professor of Archæology, published a notice of the author, with a few of the sketches. It was however reserved for the industry and enthusiasm of M. Lassus to present it to us in its entirety in fac-simile, illustrated with all the skill of an accomplished artist, and all the learning of an experienced archæologist. Of the author, Villard de Honnecourt, we gather incidentally a few particulars from a careful analysis of the legends, and a comparison of the dates of historical events with those mentioned in the book. He appears to have been born at Honnecourt, on the Scheldt, near Cambray, and he writes in the Picard patois. There is great reason for believing that he was the architect of the Choir of Cambray Cathedral, now unfortunately destroyed. He tells us that he travelled much; he visited Laon, Chartres, Lausanne, and Rheims, the latter place undoubtedly during the progress of the works at the Cathedral; we get, therefore, an approximate date, somewhere between 1230 and 1250. He was then sent for into Hungary, where he stopped many days. Now we find that in 1242, Strigonia, then the capital of Hungary, was destroyed in an irruption of the Tartars, and that on their being driven back the next year, Bela, the King of Hungary, commenced rebuilding the City and the Cathedral dedicated to the Virgin; and we may presume that Villard de Honnecourt, then a man of great reputation, was sent for to design and execute these works. It is alleged by the editor, M. Lassus, that there are various churches in that neighbourhood which exhibit evidences of French influence. All these dates and circumstances compared, give us some data for fixing the identity of the artist.

The contents of the book may be arranged under the following heads, viz.:—1. Mechanical Contrivances. 2. Geometry and Practical Trigonometry. 3. Cutting of Stones and Masonry. 4. Carpentry. 5. Design in Architecture. 6. Design in Ornament. 7. Drawing of the Figure. 8. Furniture and Utensils. 9. A variety of Drawings, sketches from natural objects or from paintings, either mural or on glass, for application to various decorative features in architecture. We therefore

see that it embraces every department of an architect's studies. Many of the sketches have legends attached, describing them with more or less minuteness. On the page, originally the first, is a legend forming a sort of introduction and proving, I think, beyond all doubt, that the Album was not a mere memorandum book for the author's own use, but that it was intended for the instruction of others, and that it contains a general sketch of the art practised in that day, as illustrated by the author's own experience. The legend reads as follows: "Villars de Honnecourt salutes you, and prays all those who work in the various kinds of work contained in this book to pray for his soul, and to remember him; for in this book one may find great assistance in learning the principles of masonry and construction in carpentry; you will also find in it, the method of drawing the figure as geometry commands and enjoins."

Under the first head, Mechanical Contrivances, we have a saw-mill moved by water power, a machine for cutting piles under water, a screw jack resembling that now in use, the method of forcing back into the perpendicular timber buildings that have bulged, military engines, mechanical toys, and a curious scheme for perpetual motion, with several other matters.

Under the second head, Geometry and Trigonometry, a variety of problems more or less useful, some for setting out, or proving the truths of the setting out of work; for a variety of purposes connected with the practical application of geometrical lines and figures in architecture; for ascertaining the measurements, dimensions, and distances of inaccessible objects; for striking a variety of curves and other things of minor importance.

Under the third head, Cutting of Stone, numerous problems and methods for setting out the lines of the more difficult and complicated parts of construction, the voussoirs of arches and vaulting in various positions, voussoirs of arches circular on plan, moulds for cutting the stones for spires, the best methods of bonding piers so as to conceal the joints, or to break joint, lines for constructing pendant arches, for corbelling from angular towers, and a variety of other matters of more or less interest.

Under the head of Carpentry, designs for three roofs and for a timber bridge. A portion of this division of the work has been lost.

In Architecture, we find internal and external elevations of one entire bay of the nave of Rheims Cathedral, and of the chapels of the choir, sections of the flying buttresses, and details of the mouldings and plans of the piers, with the bond marked; plans of the Churches of Cambray and Vaucelles, now destroyed, and of the Tower of Laon, with an elevation and sketches of the rose windows at Chartres and at Lausanne; the latter from memory, and very incorrect. The sketches of Rheims appear to have been taken from the working drawings, for they shew precisely the sort of variation likely to occur between the original design and the work when executed.

In Ornament, we have sketches of foliage, animals, grotesque and natural, and a variety of similar objects scattered through the book. In Furniture, designs for stall work, for a maison d'orologe, as he calls it, for a lectern and a monumental cross, and one or two other matters.

Under the last head there are a variety of subjects, either for mural painting, for stained glass, or for sculpture; some are particularly beautiful, as that of Christ on plate 20, and again that on plate 31; there are also some very good sketches, of which the subject is not very intelligible, but which are well worth attention; a Descent from the Cross; The Twelve Apostles; figures and compositions emblematical of various sacred subjects, suitable as decoration in various ways in ecclesiastical buildings: the figures are generally very well draped. There are also sketches from nature, academic studies, with one or two evidently from classic subjects, as one of a sepulchral monument, and some apparently of bas-reliefs representing the Games of the Circus.

It may be alleged by some that but little information of practical use can be gleaned from the

matter contained in this book ; but I submit that this wholly depends on the faculty of gathering ideas in the individual himself—to the wise a hint suffices—to the artist, to the man of idea, the barest outline, the simplest fact, is frequently suggestive of the brightest creation ; to such it is addressed, and such will undoubtedly reap profit : for the man of dull perception, of mechanical routine, for the man who mistakes an incapacity for rising above practical matters for a special aptitude, for him who learns by rote only, and practices by precedent, for such this book is certainly not intended ; but to such men, we must remember, are we indebted for much of that which renders our Art contemptible in the present day.

Having thus sketched briefly the contents of the album, allow me to say a few words on the character of the author, and of the artists generally of that interesting period, of whom we may assume that he was a fair type.

There is no pretention to mystery ; no secrets of craft. We find him a man of restless activity of mind, of singular versatility of talent, and of powers of observation at once subtle and comprehensive ; eager to gain information from every source, ready in applying it to every purpose. He appears to have resembled (taking the standard of his age) the ideal character sketched by Vitruvius—the man of universal accomplishment, the *facile princeps* in every art—trying his hand at everything and proving himself master of all. Thoroughly versed in all the practical science of his day, we should suppose that this alone was his forte, from the attention he enjoins to its precepts, did we not find that it simply assists him to the more perfect mastery of higher accomplishments. In mechanics, he gives us now a mechanical toy and now a military engine, machines for cutting timber, hoisting, screwing up, and executing the rougher preliminary operations of building. In architecture, he studies only from the most beautiful subjects and the best models, and educates his powers of hand and eye to the highest vocation of the artist. He gives us sketches of natural objects to be applied to their most appropriate places in design, drawings of mouldings, and details, all of exceeding beauty. To geometry he pays the reverence so characteristic of his age, and would fain make us believe that his skill in free-hand drawing is simply a more refined application of its principles. As an artist, he adds the finest feeling in design, in some instances, to the most enviable skill in draughtsmanship ; the conception just, appropriate, and spirituelle, expressed by the outline firm, vigorous, and free.

But applying these remarks to ourselves, and assuming him to be the type of the artists of that age, let us note particularly the wide and unrestricted field over which they spread their studies, how thoroughly eclectic they were in their habits of observation, how they swept off everything that came in their way, sacred and profane, that offered new ideas and new images ; with what honesty they set themselves the task of meeting the requirements of their age, how candidly they admitted its conditions, how thoroughly they expressed its spirit ; and this liberal, and catholic, and unprejudiced view brought its natural reward, in inexhaustible fertility of invention, in unerring propriety of application, and in matchless vigour and originality of expression. For we must remember, where genius, essentially the creative power in man, exists in the greatest degree, we shall find, if we analyse its operations, that it does not create new forms or new images, but simply creates new combinations of images and forms already existing ; and that by natural consequence, its powers are disciplined, nourished, and perfected by abundant observation, and its stores increased only by the accumulation of matter, of raw material, so to say, which it renders back again refined, wrought up, transformed, and combined in endless variety, by those processes which genius alone can effect. Can we then by study, that accumulates matter, by education that disciplines thought, hope to rival the glories of the great epochs of art ? I mean of those periods when it had such truth and grandeur, when it aimed so high, and so nearly attained its mark that it became the

standard, the starting point for everything that followed. Most assuredly not; for the true causes of this excellence lay infinitely deeper than any we can touch by the most skilful training. If we examine the history of the time we shall find that all these great awakenings, so to call them, followed hard upon some mighty political convulsion, some movement of a character so deep that it stirred up from the very bottom that class of feelings and emotions which, when the tumult has subsided, find their natural expression in poetry, and in the most truly poetical phases of art. Convulsions so absorbing in their influence that they forced everything into one channel, so comprehensive that they left no space for rival influences, so powerful that they communicated impulses of which the duration may be reckoned by centuries, and which, like undulations from a common centre, became feebler as they widened in circuit, till crossed by counter influences they exhibited only a surface of troubled water; as in our own day, heaving indeed tumultuously, but moving in no definite direction, attesting only the mighty force of the first impulse, and the elastic and impressible element through which it was propagated. Such convulsions were the Persian invasion in classic, and the Crusades in later times; for though the direction of these two great events was different, the feelings and emotions they roused were identically the same, and their effects precisely parallel. The results in each instance were precisely the same. In the Greek, of more ethereal temperament, they were more rapid, more brilliant, and more dazzling. In the Goth, of sterner mould, they were more solid and more enduring. The one gained at a bound the height, which the other reached by slower steps but sure; the influence of the one expired, for though lofty it was essentially human; the other survives, through the Divine element with which it was interwoven. I say, then, a combination of influences only, such as occur but twice or thrice in the history of the world, at particular stages of advancement in knowledge and civilization, can alone produce what we desire so earnestly to see in this our own day. Shall we, then, do nothing? Certainly not. If we cannot do all we could wish, we can easily achieve some improvement, and I would make a few suggestions in furtherance of this desirable object.

First,—That enlarged study will remove narrow prejudices.

Secondly,—That it is by thorough digestion, and not by the accumulation of matter, that we learn to invent.

Thirdly,—That to copy great works is not to imitate great masters.

Fourthly,—That it is only in the Nineteenth Century that fine art is considered one thing, and the vernacular, so perhaps truly named, another. In the Thirteenth, the vernacular expressed the popular want, the necessity of the case, the conditions of design; while fine art showed how the artist could refine what was coarse and vulgar, ennoble what was mean, and spiritualize what was gross and material; his proper and highest vocation.

Lastly,—That the benefit of enlarging our views beyond the limits of one phase of art, of adopting that eclectic method in study which enables us to appropriate some meritorious principle of another style, without confounding its distinctive character, which is chiefly expressed in detail, is singularly evidenced in the case of that particular school of artists who most strongly insist on the opposite principles; for we must admit that, after twenty years of unremitting investigation, after thousands of experiments in the revival of Mediæval art, the only symptom of real advance in meeting actual requirements by some new combination or idea, is the abandonment of the mullion, the adoption of the horizontal lintel, and the introduction of the monumental column; all so essentially classic in character that they were but a few years back instanced as a reproach to that style, as evidence of false principle and inappropriate expression. They do exist we know well in Mediæval art, but this simply adds weight to the point I insist on, viz., that it is necessary to enlarge our field of study, and to accumulate facts, before we decide on our principles, and that this point, so essential in practical science, is equally applicable to all the arts of design.

Mr. Burges, Visitor, said he had carefully compared M. Lassus' work with the manuscript. He thought the original drawings had been made with something like an ordinary black-lead pencil, probably a lead point, and that the lines were afterwards traced over with a crow quill. The ink used was generally of a brown colour, in some parts nearly black, but in others the lines were of a light yellow. De Honnecourt did not state that he built Cambray Cathedral. It was only known that he visited Hungary; but he was probably a man engaged upon one work at a time, who therefore had not the opportunity of leaving the impress of his style all over the country. It would be interesting to know with certainty whether he had made his copies from the actual working drawings. It was evident that he copied what he wanted to reproduce, with such modifications as occurred to him. His drawing of the figure was peculiar, and appeared to be a method of free-hand copying by dividing the subject into geometrical outlines, by which means he could dispense with a knowledge of anatomy; however, with all their faults, his figures were better drawn than they would be by the majority of living architects. Under the present system, drawing of the figure seemed to be quite neglected. Instead of being educated as an artist, the student was placed in an office, and told to pick up what he could; the result was, that instead of one good work on which he might display all the resources of his genius, he was often forced to produce some fifteen or sixteen small and insignificant churches. With regard to the accuracy of the printed illustrations to De Honnecourt's work, they had not been traced from the originals by M. Lassus himself, but by his clerk, who was an architect and a conscientious man. He (Mr. Burges) had compared the lithographed plates with the originals, and he thought they were, if anything, too correct, for many of the ragged lines had been rendered in fac-simile, which gave a weakness of effect to the copies, whereas the originals appeared to be drawn with a much firmer hand.

Mr. Papworth, Fellow, said Mr. Garling had set the Institute an example worthy to be followed by others who presented books to the library, which already contained many valuable works lying useless for want of an explanation of their contents. With regard to De Honnecourt's book, it was far more interesting than the preface or introduction to it by M. Lassus, the editor, who claimed for France the merit of almost all the great architectural works of the period, including even Burgos Cathedral. Indeed, all that was really good in the preface was taken from Pugin's "True Principles of Pointed Architecture." The book and the preface were, in fact, directly opposed to each other, for M. Lassus urged that no new style of architecture could be arrived at; that there must be either an entire retrogression or the adoption of a *rifacciamento* of former styles. Passing from the editor to the author, Mr. Papworth showed that, in opposition to the exclusive devotion given by each section of the profession to its favourite period of Pointed Art, De Honnecourt's mode of study was literally eclectic, as was proved by his imitations of Classical and Byzantine art, and by his studies from the life. His book was not the mere sketch book of a traveller, who brought home some 500 or 600 specimens of pretty things; he only sketched from what he thought good in its way, while by his own improvements he was actually making a fresh design of each. If it was asserted that the architecture, &c. of any period of Pointed Art could not be improved, the study of any particular phase of it might make the student a good restorer, but not an originator. The principal reflection which had occurred to him (Mr. Papworth) after looking at the contents of De Honnecourt's album, was, that architects in the present age attempted to know a great deal too much of everything beyond their own real business. It was too much to expect that architects, besides making their own working drawings, should be good painters, sculptors, and, in addition, masters of all handicrafts, whether incidental or not to the execution of a building.

Mr. M. Digby Wyatt, Hon. Sec., observed that the work under consideration was one of the

highest interest historically, if not æsthetically, for it established three facts, of which doubts had been generally entertained until the discovery of De Honnecourt's treatise, viz., that, in certain instances, in the North, as had constantly been the case in Italy, the architect and the sculptor, or the designer of the sculpture, were combined in the same person,—that the architects and sculptors of the Middle Ages studied from animate and inanimate nature freely,—and that the whole tendency of the Mediæval style, during its purest period, was to extreme simplicity of design. The parts were repeated in regular succession and reduplication, without eccentricities, to create the picturesque, as was shown by the sketches before the meeting. He (Mr. Wyatt) thought he could not offer a better sequel to the interesting remarks of Mr. Garling, than by adverting briefly to the principal working drawings of Mediæval times which had survived to the present date. MM. Varin and Didron had discovered some very curious drawings about coeval with those of De Honnecourt. These had been drawn on parchment, and after having served their purpose as working drawings, a sponge had been passed over them so as to nearly obliterate the original lines; the material on which they were drawn being valuable had been then converted into a book which was used as the register of the deaths of the chapter of Rheims Cathedral; the last death recorded in the book bearing the date of 1270. MM. Didron and Lassus (who had been invited to assist in the investigation as a practical architect), had been able to make out on these parchments a very interesting series of drawings, including a large representation of the façade of a church. In all, eighteen pages were found to be palimpsests, and of these, two had been published in the "Annales Archeologiques," (vol. V., page 92). These had been traced with a very masterly line, and with extreme severity. There was no sketching by accident in them, and nothing more was indicated than was necessary to show how the design was to be arranged. By means of axial lines the whole was set out as regularly as the most classical building could be. Other Mediæval drawings had been found in France, at Auxerre, at Montpellier, and at Bourges. At Barcelona, in Spain, a drawing of the interior of the church had been discovered. Several noble Mediæval drawings had been engraved in Moller's Denkmäler, in which the peculiar crinkled in-and-out features of the German style were handed down to us, as accurately as they could be represented in the present day. Some old drawings had also been found at Munich, and a large drawing of one of the Belgian churches had been published by M. Renier Chalon, President of the Belgian Society of Antiquaries. M. Bance, of Paris, the Architectural publisher, possessed some old German drawings; and more had been found in Germany than anywhere else. At Ulm, in the Sacristy, there was preserved a very complete plan of the Cathedral, with the name of the architect, "Ensiger," written upon it. Of the tower and spire of the same Cathedral, a magnificent drawing belonged to the Canon Schmidt. It was splendidly drawn to a large scale, entirely upon parchment, as were, of course, all working drawings executed previous to the general manufacture of paper, which existed only exceptionally in one or two localities during the latter part of the Fourteenth Century. No less than fifteen old drawings had been met with at Frankfort, and several more at Strasbourg and Cologne. The important remains, which had been found invaluable in the restoration of the Cathedral in the last named city, were well known through the archæological zeal of M. Sulpice Boisserée. Mr. Wyatt referred to the lithograph fac-simile of the drawing of the tower of Antwerp Cathedral, exhibited in the room, as remarkably illustrating the regularity and spirit of the Mediæval drawings. An even more important drawing existed of the tower and spire of St. Stephen's, at Vienna, which had been also published in fac-simile. M. Reichensperger, of Treves, one of the judges in the Lille competition, had published several drawings by Mathias Roriczer, of Ratisbon, whose very singular pinnacle was among the most curious of the masonic complications of the period in which he lived and masons triumphed. One of the morals to be derived from De Honnecourt's album was, the very complete manner in which it upset M. Lassus' introduction. It was quite evident that the Mediæval

artist was an active-minded individual, a thorough Eclectic; and if in the present day the style of the Thirteenth Century could be accepted as a type, and if the watchword of De Honnecourt were adopted, namely, the union of technical study with an earnest craving to advance on what had been done before, there might be great hopes that our works in the Mediæval style would become living realities, instead of the dull reproductions they now too often are.

Mr. G. Gilbert Scott, Fellow, observed that it was interesting to see something, however little, of the interior of the studio of an artist of any great period. It would, for instance, be of the greatest use if we could learn how and in what spirit the Greek architects expressed their ideas in private. Mr. Garling's paper was one which ought to excite interest, if only from its important bearing upon the history of their art; and even if M. Lassus' suggestions were somewhat conjectural, it should be remembered that mere conjectures had their value. The idea that De Honnecourt introduced French Gothic architecture into Hungary was an interesting subject for investigation, although the grounds on which M. Lassus argued the point were rather slender. But, passing by these conjectures of the editor respecting the origin of De Honnecourt's mission to Hungary, upon which the artist himself had not thrown any light, he (Mr. Scott) would mention, as one of the most interesting points in De Honnecourt's book, the manner in which he appeared to have seized upon everything he saw at all likely to aid him in his art, and the marvellous facility with which he sketched it. Speaking generally, he (Mr. Scott) did not believe that architects of the present day could draw the figure so well as De Honnecourt. Mediæval drawing might be considered quaint, and that of our own day excessively pretty; but, quite apart from the sketches of De Honnecourt, he would suggest what had long pressed itself upon him as a very important practical consideration, that, in all great periods of architecture, the amount of skill in drawing, whether more or less, was directed to the great object of rendering the work itself artistic, particularly in its decorative features, and very little of it to making pleasing pictures of the building, either before or after its execution; whereas, at the present day, the reverse was the case; the artistic attainments of architects, whether Classic or Gothic, being, with some exceptions, mainly devoted to making pictures of buildings, and only in a secondary degree to the perfecting of the artistic portions of the actual work. He could mention several gentlemen of both denominations who could draw in a most magnificent manner; but he had long felt the want of schools for artistic training, in which students should be systematically instructed in those higher branches of art which do not bear upon mere picture making, but upon the actual art to be expended on the works themselves.

Mr. Donaldson, H.S.F.C., thought that M. Lassus' introduction to the Album contained many valuable truths and suggestions. He had himself been rather displeased with it on a first perusal, but was disposed to consider it as the production of a thinking mind, and one which (with a certain reservation of opinion) might be read and studied with great advantage.

Mr. Marrable, Fellow, differed from the concluding remarks of Mr. Scott, as to the incapacity of modern architects to make correct drawings from which the men could work. According to his experience every architect worthy of the name was capable, and many of them were indeed artists who could represent their designs in an artistic and pleasing way, without confining themselves to such rough and rude drawings as those of De Honnecourt. He could not but regret that so much time and patience had been devoted to preparing a paper, which was more interesting in an archæological than in an architectural and practical point of view.

Mr. M. Digby Wyatt observed that the history of art was the best lesson to set before the student, old or young, and without going so far as Mr. Scott in depreciating the practical artistic works of the majority of the architects of the present day, as compared with those of the older archi-

tects, he believed that a very great and valuable lesson was to be learnt from any traces of their mode of practice and study which could be rescued from the past. On these grounds he certainly believed that Mr. Garling's paper had been judiciously brought before the members.

Mr. Penrose, Fellow, said that the Institute had often received papers that were too strictly archæological, but the present, though treating of what was old, was architectural. It touched moreover closely upon realities, and was essentially valuable as giving an insight into an ancient studio. It was in fact a paper of practical importance; and thanks were fairly due to Mr. Garling for the pains he had taken in bringing it forward.

The vote of thanks having been carried, the meeting adjourned.

ON THE GREEK CANON OF THE PROPORTIONS OF THE HUMAN FIGURE, QUOTED BY VITRUVIUS.

By Joseph Bonomi, Esq. Read at the Royal Institute of British Architects, Nov. 29th, 1858.

It has been remarked, that although all nature bears the impress of law, to men in general, she presents only a number of detached phenomena; to the diligent enquirer alone, or to those whose mental vision is acute enough to discover some link in the secret chain of her laws, does she gradually unfold all the relation which these phenomena bear to each other. Thus the laws that govern the analogy, or proportion, which the several parts of the human structure bear to each other, although very anciently sought, were probably not entirely discovered, or entirely recorded, till sixty years or more after the birth of Phidias, at which time, Polycletus, a famous sculptor of antiquity, made a statue so exact in all its proportions that it was considered the most perfect model of a full-grown man. This statue furnished the canon or law of the proportions of the human figure, which from that period is said to have been observed by all the sculptors of antiquity.

Part of a canon or record of the proportions of the human figure, is preserved in the Second Chapter of the Third Book of the Treatise on Architecture by Vitruvius, in which book that learned architect treats of the proportion, or analogy, which the several parts of an architectural structure should bear to each other, and enforces his argument by a reference to the human frame, in which he tells us certain affinities exist, which were always observed by the most celebrated of the ancient painters and sculptors. This part of the Treatise is obviously a quotation, probably from the writings of the ancient sculptors or painters then in existence, and most probably from the canon of Polycletus.

I will now proceed to read this part of the Third Book in the translation by Professor Wilkins, notifying certain variations in an Italian version of the same text by Leonardo da Vinci,—"Nature, in the composition of the human frame, has so ordained that the face, from the chin to the highest point of the forehead, whence the hair begins, is a tenth of the whole statue; the same proportion obtains in the hand, measured from the wrist to the extremity of the middle finger. The head, from the chin to the top of the scalp is an eighth, and as much from the bottom of the neck.* From the top of the chest to the highest point of the forehead is a sixth; to the top of the skull a fourth.† If the length of the face, from the chin to the roots of the hair, be divided into three equal parts, the first division determines the place of the nostrils; the second, the point where the eyebrows meet. The foot is a sixth part of the height of the entire frame; *the cubit* and the chest are each a fourth." ‡

"The other members have certain affinities which were always observed by the most celebrated of the ancient painters and sculptors, and we must look for them in those productions which have excited universal admiration."

"The navel is naturally the central point of the human body; for if a man should lie on his back with his arms and legs extended, the periphery of the circle which may be described about him, with

* This last sentence is irreconcilable, and does not occur in Leonardo's version.

† A *sixth* part is given to the distance from above the chest to the highest point of the forehead; and from the same point to the top of the skull is a *fourth* of the whole stature. In this sentence there is obviously a mistake in the numbers, which is corrected in part in Leonardo da Vinci's translation. It should be a *seventh* part is given to the distance from above the chest to the highest point of the forehead; and from the same point to the top of the skull is a sixth. The fourth is from the line, which crosses the breast at the nipples, to the top of the skull.

‡ Leonardo makes it a seventh. In the best antique statues it is something more than a seventh, but not quite so long as a sixth.

the navel for its centre, would touch the extremities of his hands and feet." With respect to the extremities touching the periphery of the circle it is clear from the diagram that if the arms be raised above the horizontal, touching the top of the head, or not quite so high as the horizontal, the extremities of the hand will not touch the periphery. So likewise if the legs be expanded beyond the equilateral triangle, or more or less than 60 degrees, the feet will not touch the periphery.

"The same affinities obtain if we apply a square to the human figure; for, like the contiguous sides, the height from the feet to the top of the head is found to be the same as the distance from the extremity of one hand to the other, when the arms are extended."

"The standards according to which all admeasurements are wont to be made, are likewise deduced from the members of the body; such as the digit, the palm, the foot, and the cubit, all of which are subdivided by the perfect number which the Greeks call Teleios." *

It will be observed that there is no such division in this ancient canon as that adopted by Audran, the Count de Clarac, and all modern artists,—the division of the head into four equal parts. It will also be observed that all the propositions here laid down relate to the longitudinal divisions of the human frame except only one, which bears reference to the width of the shoulders; for the transverse dimensions differ very considerably in every individual, and it is in these measurements alone that the difference between a Hercules and an Apollo, a Mercury and a Jupiter, are to be sought, but for which no law or canon is given.

With regard to the longitudinal proportions in this canon, however, I shall be able to show that they are the normal proportions of a full and well-grown man equally removed from two opposite qualities of growth; namely, that quality of growth in which the characteristics of the infant are retained in a greater or less degree,—as for example, a large head, long body, and short extremities; and equally removed from that opposite quality of growth in which the characteristics of the adult are exaggerated,—as for example, a small head, a short body, and long extremities.

To illustrate the first mentioned quality of growth, I have brought a small ancient statue of the Egyptian god Pthah, and for an illustration of the second quality of growth, I must refer you to the engraving and description of a statue in the beautiful work of the Count de Clarac, Vol. v. plate 840. The statue alluded to is in the marble of mount Hymettus, and therefore, probably, a Greek work, nevertheless it is remarkable for the disproportionate smallness of the head, and the length of the extremities.†

Now, according to this canon, you will observe, that the measure from the crown of the head to the sole of the foot is exactly equal to the measure from the extremity of one hand to the extremity of the other, when the arms are extended. This exact equality of measure, we shall find, is the normal affinity or proportion which should exist between these two dimensions of the human frame; for if any given number of persons whose occupations and habits of life are conducive to the full development of the structure be measured, it will result that in nearly half the number, the measure of the entire height will exceed, in various degrees, the measure of the extended arms; that in the other half, the measure of the extended arms will exceed, in various degrees, the measure of the entire height; and that only a few in each section will correspond exactly to the proportion given in this canon. Thus, then, the normal proportion or affinity which should exist between these two dimensions of

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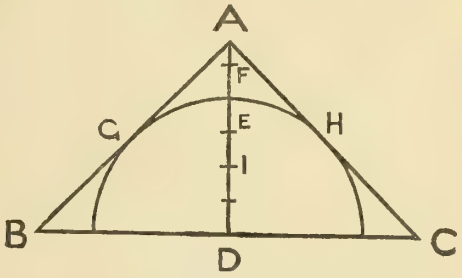
* That is to say, those numbers (6 and 28) which are equal to the sum of their factors or divisors, were called *τέλειοι*, —*e.g.* $3+2+1=6$, and $1+2+4+7+14=28$; and 6 is the number into which the cubit is divided.

† This statue was found in making an excavation in the Trastevere in 1849. It is larger than life, and represents an Athlete using the strigillum, and is now deposited in the Museo Chiaramonti.

the human frame is established to be exactly equal, the mean measurement between the two great sections confirming the canon. In the same way, or by an analogous process, have all the other affinities recorded in the canon and set forth in the diagrams, been ascertained.

I need not dwell, in this room, on the necessity of producing strictly (what may be called) geometrical elevations of the human figure in the elucidation of this subject, and also for explaining a most ingenious discovery appertaining thereto, by our celebrated countryman Mr. John Gibson, and by which, in practice, precisely the same proportions of the figure may be attained that have already been quoted from Vitruvius. The invention I am about to explain Mr. Gibson has allowed me to place in the hands of his brother artists in a small pamphlet on the subject of the proportions of the human figure.*



Mr. Gibson directs that the sculptor should draw a right angle triangle having the two sides A C and A B, that subtend the right angle, equal to each other. From the centre of the hypothenuse, D, describe a semicircle which shall touch the lines A C and A B. Draw a line from D to the apex A. Divide this line from D to the periphery E into four equal parts. Make E F equal to one of those parts. The diagram thus constructed contains all the dimensions of the principal divisions of the human figure. For instance, the hypothenuse B C represents a measure that is repeated three times. First, from the heel to the middle of the patella; secondly, from the middle of the patella to the superior spinous process of the ilium; thirdly, from the bottom of the abdomen to the pit of the neck. Thus, the hypothenuse of the triangle furnishes the measure of the distances from each other of three very important points or divisions of the human figure, both in the perfectly erect position, and in that of standing at ease.

The sides of the triangle, A C or A B, represent a measure that is repeated five times in the same figure. Namely, first, from the top of the instep to the bottom of the patella; secondly, from the top of the patella to the pubis; thirdly, from a little above the navel to the pit of the neck; fourthly, from the top of the shoulder to the point of the elbow (of the straight arm); and fifthly, from the elbow to the knuckle of the middle finger. Thus, the measure of five very important divisions of the human structure are ascertained by the sides subtending the right angle.

The remaining dimensions for completing the structure are contained in the line A D, for from D to I is the length of the neck; from D to E is the length of the face, measured from the chin at its juncture with the neck to the highest point of the forehead. From D to F is the measure of the head from the chin to the top of the scalp, taken in the direction of the red line in the drawing; and lastly, from D to A is the measure of the foot from the heel to the end of the great toe.

All these measures obtain exactly when measured with the callipers on the finest Greek statues, and on the best living models; but, you will observe, as indicated by the red lines on the drawings, these measures are taken obliquely, and in some instances inclining in two directions, as, for example, that from the heel to the middle of the patella inclines outwards in the front view, and

* "Proportions of the Human Figure, by Joseph Bonomi, second edition, Chapman & Hall, London, 1857.

forwards in the side view, which two obliquities reduce the vertical measure of the distance of the middle of the patella from the ground to the level, corresponding exactly with the middle of the patella, as obtained by the Vitruvian canon; so, likewise, do all the measures obtained by the triangle of Gibson coincide exactly with those designated or obtained by the four horizontal divisions or lines of the Vitruvian diagram. This accordance of the Vitruvian canon, with the practical method invented by Mr. Gibson, is further demonstrated by the perfect similarity of both halves of the figure in the drawing, half of which is constructed according to the Vitruvian canon, and the other half according to the simple and practical invention of Gibson, a remark that applies equally to the two profiles of the same figure.

As before stated, all the proportions given by the triangle of Gibson obtain exactly when measured by the callipers on the finest antique statues, and on the best living models of both sexes; only those however which have but one inclination can be measured with the compasses on these geometrical elevations; this circumstance alone determines the inadmissibility of perspective delineations by way of elucidating the subject, for in drawings in which that essential element of the painter's art is admitted, no measure at all can be taken. The two profiles and front view of the same figure standing at ease are exhibited in the diagrams in strong black lines, while the faint red lines show the same figure in the perfectly erect position; by the change from the perfectly erect position to that of standing at ease, one-fourth of a head, or in other words, a thirty-second part of the entire height is lost.

The centre of gravity is removed one inch and a quarter from where it fell in the erect figure, of six feet high, namely, from between the ankles to nearly the middle of the ankle of the leg, which sustains the whole weight of the body, while in the profile it remains where it was in the erect position. Also, it is to be remarked that by this change of posture, where the black contour departs from the red contour on one side, there is an exactly corresponding departure on the opposite side, or, in other words, the excess on one side is balanced by an exactly corresponding loss on the other.

The remarks I have had the honour to address to you would be lengthened to an undue extent by referring to a work of Albert Dürer, on the "Symmetry of the Human Body," * illustrated by about two hundred woodcuts. However useful and curious this extensive treatment of the subject may be, it does not appear to me to supersede in any degree the valuable text of Vitruvius, as elucidated by Leonardo da Vinci, and considered in connection with the practical discovery of our celebrated countryman, Mr. John Gibson.

Mr. M. Digby Wyatt, H.S., enquired how far the Greek canon corresponded with the proportions found in Egyptian figures. He believed the Egyptian sculptors had adopted several scales, and that their works approximated nearer to the Greek system when the country was under the dominion of the Ptolemies than it had under that of the Pharaohs.

Mr. Bonomi said there were two or three different scales for Egyptian figures. The Egyptian sculptors divided the erect figure into nineteen parts, and by the use of the scale so obtained they arrived at a certain degree, but not at entire perfection in their works. He agreed with Mr. Wyatt's last remark, and produced two small specimens as illustrating two different types of ancient figures. One of these, which was Egyptian, and probably 2000 years old, represented the god Pthah, and gave all the proportions of the infant; in the other on the contrary all the parts were elongated. The first was characteristic of the growth of dwarfs, the latter of giants.

Mr. John Bell, Visitor, said it was stated that, after the execution of the perfect model of the statue called "the Rule" by Polycletus, most of the Greek sculptors followed the proportions of that figure. The proportions were, however, often varied by the Greeks for the purpose of architectural effect.

* "De Symmetria partium humanorum corporum."

Thus the thigh of the Theseus, which projected from the pediment of the Parthenon, was shorter by an inch and a half than the other, in order, probably, that the limb should not appear to project too much over the cornice. In a figure standing on one leg the joints were pressed together, and the height was shortened; this condition was sometimes exaggerated by the Greeks. He believed it would be found that the leg on which the Apollo Belvedere rested was shorter, in a somewhat exaggerated degree, than the other, which was comparatively pendant. It was stated that Lysippus made his figures taller than other artists, and this fact was cited as a proof of the decadence of art in his time. It had occurred to him (Mr. Bell) that Lysippus adopted this system after executing many portrait statues of Alexander the Great, who was short in stature, and whose limbs he had to lengthen in the copy to give them proper effect. As to the difference in the length of the arm when in a bent position, he thought that the bending did not affect both divisions of the limb.

Mr. Westmacott, Visitor, hoped to see the pamphlet by Mr. Bonomi, from which the drawings before the meeting were taken, in the hands of many more artists. At the same time he felt that theorizing on the proportions of the human figure had a tendency to render sculpture too mechanical. The proportions of the figure as laid down by Vitruvius were perfectly right; and they were those of the bones, neither more nor less, whereas the beauty of the ancient statues arose from the proportions being varied in action, in which the bones were not seen. In a state of rest the legs would appear of less length, but in action the whole character of the figure was altered. The Apollo was, perhaps, not to be too much depended on, as it was considered to be a copy from a bronze, and one of the limbs had been mended: still the extended leg was represented according to the law of nature. Mr. Westmacott entered into some anatomical details to shew that variations in length might arise from the loosening of the cartilages, without affecting the canon laid down by Vitruvius, which he believed was the true canon of the bones; but it must be well known that the antique statues did not measure in strict accordance with that canon. The British Museum now contained statues of the periods of Phidias, of Praxiteles, and of Lysippus. The last-named sculptor was remarkable for making the heads of his figures small; thus giving the effect of greater height to the other parts. Although he thought that all figures modelled upon the canon must give satisfaction, because proportion was as essential in art as in music, yet he could not believe that a perfect statue could be produced by merely attending to proportion alone. Though Polycletus established a canon of proportion, and was considered a master in his art, another sculptor had been styled more harmonious than Polycletus: harmony must affect proportion. He had not the slightest doubt that Mr. Bonomi's frame-work was perfectly correct, but he could not admit that statues constructed entirely by copying a canon of proportion would be beautiful works of art. Correct they might be; but beauty depended on such minute varieties, and the varieties of nature were so great, that he was afraid the most beautiful works of art would not bear Mr. Bonomi's *crux*, since due scope must be allowed for the genius of the artist. At the British Museum there was now an opportunity of comparing and contrasting the sculptures of the Athenian, the Phigaleian, and the Halicarnassian collections. In all these there was a high degree of elegance, but an elongation of the proportions of the figures in the last named gave them a remarkable increase in beauty.

Mr. Edwards, Visitor, said the different height of the figure in an erect posture, and in a state of ease, was to be accounted for anatomically, and that the shortening must be greater in a young person, whose bones had softer and more elastic terminations than those of an adult. He inquired whether the canon quoted by Vitruvius would apply to all nations. Sir Charles Bell, in describing works of art at Rome, had stated that he could distinguish at once such of the antique portrait statues as represented Romans, from their squareness of build; so also figures which followed the canon

brought before the meeting would be Greeks. All had a perception of truth, and on seeing a figure at rest could allow the proportions to be in accordance with the canon; and from the perception of truth naturally arose the feeling of satisfaction.

Mr. Bonomi said that his diagrams gave no measure of the leg which did not bear the weight of the body.

Mr. Jennings, Fellow, said that as no doubt different nations had adopted different styles of figures, the attempt now to imitate the Greeks in a slavish manner would not produce the desired result. He believed the Greeks were a more beautifully formed race than the English, and it seemed that in the Roman figure there was also a deterioration. At the present time the sculptor, he believed, found great difficulty in obtaining a perfectly good figure as a model. Workmen in different occupations might be found finely developed in the particular muscles which they most exercised, but it appeared that the Greeks enjoyed the great advantage of being able to study from one figure only, and that, probably, approaching perfection. It had been observed by Leonardo da Vinci that he studied defects in order to avoid them; and it struck him (Mr. Jennings) that they should themselves, as artists, adopt the same course, by improving upon every grace and avoiding as far as possible every defect in all the works they saw. It was of course desirable to have a canon of proportion, but the main object should be to study effect: to study the English figure and to reproduce it properly in English works. Both in architecture and in sculpture the object should not be to copy merely by rule and line, but to seek to arrive as far as possible at perfection, by careful study and observation.

Mr. M. Digby Wyatt said it was a singular circumstance that the canon under discussion, probably originated by a sculptor—Polycletus, had been handed down through the instrumentality of an architect—Vitruvius, and a painter—Leonardo da Vinci. It was evident from the text of the latter that he looked upon the human structure as an edifice; and it would be desirable that architects should look upon the symmetrical principle upon which the human frame is constructed as suggesting the mode of distribution after which they might design their edifices. These canons of proportion which could have been fixed only after a long and patient observation of coincidences, proved that there was a regular geometrical and arithmetical relation between all the different parts of the most beautiful work of creation. In all well developed figures, of whatever race, the general scales and proportions before the meeting appeared to obtain pretty universally as the normal condition of the human frame, being only varied in the case of a deterioration of race, from unwholesome occupations, or other causes; but, as Mr. Jennings observed, for details of character and expression the sculptor might follow the English type with advantage. One point which was most interesting to them as architects, was to observe the different effect of figures at different heights and distances from the eye, and to take care that sculpture, as an accessory to architecture, should be treated and modified according to its position. As a case in point, he would refer to the casts of the figures from the west front of Wells Cathedral, which had been taken under his directions for the Crystal Palace Company. Although slightly elongated the originals looked well in their places, but he found that the casts could not be put up in the Mediæval Court at the Crystal Palace without considerable modification. Two or three of them in fact were several heads too high, and the sitting figures were so proportioned that they appeared to have scarcely any thighs at all. The architect and the sculptor had, however, worked so well in combination, that these defects, obvious enough when the statues were brought to the level of the eye, were not visible from the point at which the statues were best seen in the front of the Cathedral. It was a great matter for the artist, whether sculptor or architect, to ensure a good optical effect for his works when placed in the position they were intended to occupy; hence this working together of the architect and of the sculptor must be attended with the best results for both

parties, and it was a very great mistake on the part of the sculptor when he shewed his independence of the architect, and, as in some instances, thought fit to follow his own conceits by placing a fine statue upon a plain square block.

Mr. Twining, C.V., pointed out the necessity the sculptor laboured under to exercise thought and contrivance in order to produce variety in the attitudes and expression of his own particular works, so that they might be constantly agreeable, and never monotonous, or imitations of the productions of other artists.

Mr. John Bell agreed in the remark made by Mr. Wyatt as to the importance of the union of architecture and sculpture. In connection with Greek and Roman architecture, a less amount of departure from rule in the proportions would be required in placing a seated figure at a great height, than in the Gothic style. Even in that case, however, the architectonic question should not be overlooked. All figures should be so modelled as to look well in the places for which they were intended. The canons of form laid down by Vitruvius, as well as that by Gibson, were of great value, and had been most clearly expressed by Mr. Bonomi. Of course it did not follow that they should be exactly observed in every case. It was not desirable that all sculptors should make their figures exactly alike, nor was it likely they would. No doubt the great thing to be produced in a statue was to represent the largest or strongest man in the smallest compass, but it would be wrong to represent a monster of strength, or a monster of rapidity. Unquestionably, the standard of form varied in different races, and in all the examples he had seen of Negroes and Africans, the forearm was longer than it was in white men. The Greek canon must have been based upon a very fine race, but the best proportioned of the human family in any part of the world, would not much vary from that standard, and his own experience led him to believe that the English form did not differ much from the Greek type.

Mr. C. H. Smith, H.M., called attention to the remark of Sir Joshua Reynolds, that there could not be a greater mistake than to suppose that rules were the fetters of genius; but that they were fetters only to men of no genius.

Mr. Kerr, Fellow, said that nothing had been adduced to dispute the title of the Greeks to the palm of excellence and artistic development. Vitruvius had brought before them the perfection of divine work, proving,—whether right or wrong as to his details,—that there were some laws or principles governing the proportions of the human frame. Whether these, as he said, were arithmetical, or, as Mr. Gibson said, geometrical, did not matter. The human figure at rest pleased by its perfect symmetry; in motion, by its variety; but this variety was only satisfactory from its perfect *balance*, without which there could be no beauty. Now, this principle was sometimes forgotten by architects. He did not uphold perfect symmetry, but modern designs were too often contortions, which were always unpleasing. He had never been able to see any reason why a geometrical proportion should exist in nature's works, and the asserting it was like attempting to square the circle. He, for one, should say that Gibson's canon was wrong, and that of Vitruvius right; but when it was impossible to reconcile the two, then Gibson's theory might prove right, because of its correspondence with the other.

Mr. Bonomi concurred in this remark, referring to the diagram, showing one half of the human figure drawn on Gibson's theory, and the other half on that of Vitruvius.

Mr. M. D. Wyatt thought they might be misled if they distinguished between arithmetical and geometrical proportion, because all geometrical lines were capable of arithmetical definition, with infinitely fractional discrepancies; and a figure which conformed to any geometrical law, must conform

also to some arithmetical ratio. Geometrical laws singularly agreed with, and could be generally expressed by an arithmetical system of notation. The difference it was well to insist upon was rather between arithmetical and geometrical progression than proportion.

Mr. KERR replied that all geometrical proportions were in fact absolutely irreducible to arithmetical proportions. If the former agreed with the latter, he would ask the use of any geometrical proportion at all ?

Mr. PARRIS, Visitor, observed as a fact, not very generally known, that all the principal limbs and parts of the human figure consisted of 32 bones,—a multiple of two or four, but never of three. This applied to the head, arm, leg and spine, with the ribs, &c.: the scapula and clavicle, with the hand and wrist being considered as belonging to the arm, that limb consisted of exactly 32 bones, and so with the rest. The same, or a similar standard of analogy, should exist in the construction of a building. He did not himself imagine that every Greek was a perfect model of form, and models might be found in Cheshire and Lancashire to compare with the finest Greek examples. Everything depended upon giving to the figure the expression of the proper sort of strength, whether that of a warrior, a boatman, a gladiator, a prizefighter, or a coachman: and the little variations necessary in each case would not be found to deviate much from the perfect standard. In architecture, he thought, a building should tell its tale as a stone picture at once, and unless it did so it must be wrong in principle, whatever its proportions might be.

Mr. CHARLES BARRY, Fellow, remarked that architects had sometimes been reproached with their indifference to scientific and abstract subjects. The present paper had, however, met with a very willing audience, and had elicited many valuable remarks. Drawing from the figure, which was not common in the architect's office, might be practised by the student with very great advantage. There was some sort of analogy between the train of thought which would actuate a sculptor in designing a statue, and an architect in designing a building, and there were well recognised canons in each case which could not be disregarded without danger. It must, however, be borne in mind, that precisely the same canons would hardly apply to a building, and to the human figure.

Thanks having been carried to Mr. BONOMI, the meeting adjourned.

ON THE GEOMETRIC TREATMENT OF SCULPTURE.

By John Bell, Esq. Read at the Royal Institute of British Architects, Dec. 13th, 1858.

Those who at the last meeting in this room heard the very interesting paper contributed by Mr. Bonomi, "On the Proportions of the Human Figure," as laid down by Vitruvius, Leonardo da Vinci, and others, will deem me fortunate in having been preceded by a theme which so aptly introduces that of this evening. I feel this the more, inasmuch as the theory of the proportions of the human figure, quite a sculptor's subject, was then received and discussed in a spirit which showed how much interest was taken in it by the architect, and how ready he is to welcome it as connected with his own department. It is natural that this should encourage me in presenting the following remarks to you on a subject of a somewhat kindred nature.

The following little paper "On the Geometric Treatment of Sculpture" has arisen from the suggestion of one of your honorary secretaries, Mr. Digby Wyatt. Its title will be accepted, I think, as grouping together conveniently some considerations of much importance in the association of my art with yours, and on which I venture to offer a few remarks. These may afford, at least a sculptor's view of the subject, which has here the best chance of being checked and guided by that of the architect. If anywhere I perchance use a tone of assertion, pray do me the justice to consider that it is only for shortness, and not from confidence. What, then, may the title "Geometric Treatment of Sculpture" be held to imply? Using the word geometry in its accepted sense, I would submit, that selection of forms and masses founded on lines of geometric contour, as straight, square, circular, elliptical, pyramidal, or wave-like, &c. which especially suit sculpture for the purposes of harmonious decoration. Now, although no doubt a work of sculpture, as a unit, and isolated, is the better for being of a symmetric outline, and well balanced and adjusted in itself as an ornamental form, yet still more is this the case when it is regarded in reference to those situations in which sculpture is usually placed, which also, I conceive, may nearly all, more or less, be considered architectural. In a garden, for instance. Those gardens which are suitable for such decorations as vases, statues, or fountains, are more or less on a symmetric plan, and may all in degree be considered as extensions of the house itself to which they are attached,—as its outer works, as it were, and as affording apartments with walls indeed, but with no roof but the sky. Under this aspect, none of such decorations of art as are introduced in these situations are altogether beyond and without the bounds of architecture, but their effect will be influenced in a large degree by the same laws under which they appear within the immediate courts, halls, and apartments of the edifice itself. When, therefore, a work of sculpture on its pedestal is placed in a garden, the two together, as a mass, will have the best effect if they justly subserve some theory of decorative arrangement which requires in that spot an architectural feature of that quality. I say this in order to acknowledge that, even when not directly associated with architecture, it may be very well for sculpture to hold itself bound by the same ties of geometric harmony as if in nearer relation. Of course, when more closely connected with the sister art, as in statues to fill niches, relievi to occupy panels, figures to become the finials of columns, or extended and diversified compositions to adorn and enhance the tympanum of a façade or the summit of a triumphal arch, the geometric treatment of the sculpture becomes more intimately an architectonic question. So vital a one indeed does this appear in these cases, as regards the eventual effect of both the building that is to be adorned and the sculpture that should adorn it, that there seems but a remote chance of a happy result, unless a geometric laying out of contours and masses, and light and shade, has formed the ground-work of the design. In such cases the most delicate and

artistic detail will fail to make up for deficiencies in geometric plot, which latter consideration, however, having been regarded, no doubt the more beauty of finish in details the better, as the Athenian has so well illustrated in the exquisite workmanship of those figures which remain to us from the tympana of the Parthenon, which were viewed at an elevation of more than 50 feet. It appears, therefore, that sculpture should never lose sight of those family ties which bind it to architecture, and by which so much mutual benefit is to be attained. The freedom of sculptural lines which she draws from the contours and movements of vital forms may well give flow to the stricter types and masses of architecture, while, on the other hand, the latter, spreading out and aspiring more under the steadfast laws that inform the mineral kingdom, may lend in turn to sculpture the most valuable hints of geometric construction. And this holds even in cases where the sculpture is not in direct association with architecture, but is a principle also affecting the art by itself, insomuch that a work of sculpture is ever the more perfect in itself when its general contour possesses that quality and character of geometric symmetry which fits it for an architectural decoration. In illustration of these remarks I have selected a few works of ancient and modern sculpture, which you see before you. I have necessarily been limited in my selection, and I have also thought it best to obtain small copies of these works instead of the large originals; and the more so, inasmuch as my present theme only relates to the general treatment of mass and line, which these reductions will serve to illustrate pretty nearly as well as the larger originals, some of which also would have been out of the question to bring here. In these examples, familiar because they are good, like the good tunes in the streets, the eye acknowledges, I fancy, at once the advantages of geometric treatment and balance which they possess, and in which they advance the valuable precedents of the best masters.

It may be, however, as well to make here, *in limine*, an acknowledgment that there are exceptions to these precedents. In such cases, however, we cannot tell how far such examples as do not possess this even adjustment were intended to act as one of a pair; in which case, although when considered as units they do not balance, yet as parts of a twin decoration, they might do so most agreeably, as is the case with the ears of a sarcophagus, or the handles of a vase, which as units are irregular, yet as a pair regular, and though singly uneven, yet when justly disposed, are mutually responsive, as is seen in the two-side figures of the Medici tomb before you. Had either of these two figures been found separately and alone, in an ancient ruin, its form would have been deemed irregular; but as they exist now according to the artist's original plan, they are an apt example of geometric and responsive arrangement. I may as well acknowledge, however, that the more I see of works of art the more vain it appears to me to attempt to erect *perfect* canons of taste or treatment. A perfect canon in such matters appears as impossible an existence as that of a perfect specific in medicine. Thus in this case, although geometric treatment is undoubtedly an element of fine sculpture, and although certain cases of apparent divergence from this rule may be argued away, yet without pedantry or special pleading, it cannot but be allowed that there are some noble works which appear to play truant to these rules. This remark, however, chiefly applies to figures in the round, in which in any decided action it will be recognised at once that a form of geometric symmetry could scarcely be obtained in all views. In these cases it will be admitted that that arrangement is the most happy which gives the front and principal view, with the best balanced decorative form.

The noble statue of the Belvedere Apollo, and the Borghese Diana, are in some views of an irregular contour, and yet in others they present one sufficiently geometric to render them suitable for central forms without a pendant, especially in the centre of an ample space, and comparatively aloof from such lines of architecture as would emphasize their departure from the balanced character of an architectural finial. Although, however, some views of these and other figures may be irregular,

yet I conceive that even in these cases, the desire is perceptible to obtain, as much as the subject and action admitted of, a well-balanced and geometric form. Also with respect to the above-mentioned two statues, we do not know how they were originally placed. The colossal cruseo-elephantine works of Pheidias, the Jupiter at Elis, and the Minerva of the Parthenon, are recorded as having been evenly balanced works, while we are also informed that they were symmetrically placed within the temples that contained them. Without further introduction, I would now advert to two forms of geometric character, to which various of the best works in the round of ancient and modern sculpture appear to incline. It is on this account, and on that of their simplicity, that I speak of them especially, and not, of course, with any idea of excluding other geometric resemblances or types. I allude to the forms of the Pyramid and of the Vase. These are types which not only mould the masses and contours of compositions in the round, agreeably as sculpture *per se*, but by the same influence suit them for the purposes of architectural enhancement. In regarding examples of these treatments, however, we must not, of course, expect perfect pyramids or perfect vase forms. The conditions of vital forms are not such as to be confined within limits so rigid, and we can only expect such coincidence as may evidence the plan of their geometric conception. In some works, also, we shall perceive the pyramid tall, like an isosceles triangle, in others flat, and spread out as in the Dying Gladiator, or the exquisite figure of Eve by Baily, which is before you in small (a joy for ever as long as sculpture lasts). In one statue or group we may recognise the contours of a tall vase; in another, that of a broad wide one, as in a seated figure. The grand and expressive group of the Laocoon aims evidently at a pyramidal form, though this is somewhat blown aside by the gust of passion and of pain. The great group of Dirce and the Bull, of which there is a full-sized cast at the Crystal Palace at Sydenham, is on a similar principle, as it is, at some sacrifice, made more or less pyramidal on all four sides. The group of Niobe and her youngest daughter, among other works, evinces an intention towards this form, and in most of these there is a near coincidence with that of a flame of fire, which has ever a tendency towards the pyramid. Milton speaks of Satan, when touched by Ithuriel's spear, as springing up "like a pyramid of fire," and even the word pyramid is derived from this source. This form is also finely present in the general composition of the tombs of the Medici, as illustrated by the engravings before you; in which, although the parts are so boldly cast about, and so grandly diversified, yet this is effected without disturbing the general geometric arrangement which is here so finely preserved. As I can only touch lightly on the details of my subject, I will now pass on to the second form I have indicated as frequent in fine statues and groups, that of the Vase, and to cite some examples which partake of the general form of a vase-like finial, of which a few familiar examples are before you. The outline and general contour of the far-famed Venus de Medicis affords, especially in the front view, the general balance of a vase-like finial. The Eracles of Glycon, commonly called the Farnese Hercules, although a figure as far removed as possible from this in character, has a similar quality of arrangement, only it is wider at the foot. Both these statues possess, to a great degree, in their principal view, an evenly-balanced vase-like contour. And this quality, no doubt, has had a very large part, along with their other merits, in obtaining for them that great popularity which they have ever enjoyed. They were more repeated in ancient art than any other statues; one great cause of this being, no doubt, that, in consequence of their geometric arrangement, they were found so very convenient as architectural decorations, and we sculptors may well keep this point in mind when we desire a wide-spread public for our efforts, and try to work for posterity. The cloaked figure of the Phocion, also before you, presents a similar character of contour, illustrating the application of a vase-like outline to a portrait statue. There is, however, another well-known treasure of ancient art that still more presents perfection as a vase-like finial, viz.: the

well-known classic group of Cupid and Psyche embracing, of which a little copy is before you. Turn it which way you will, in each view it preserves the just balance, elegant proportions, and general mass of a tall taper vase. In this exquisite and graceful group we possess a charming example of geometric balance and contour applied to the human form, and of the perfect coincidence of the architectural, decorative, and sculptural elements. Again, accordingly, has ancient and modern repute followed this combination of merits, and in later times this group has been more frequently introduced into paintings than any other work of sculpture. I have before alluded to my disinclination to the pedantry of positive canons, and thus I would now again remark that although symmetry of form of this character endows a work of sculpture with a great charm, insomuch that its high value may be received as an axiom, yet occasionally divergence from this may be not only allowable, but even of great service in emphasizing the action and expression of a statue, and that without injuring the effect of its architectural associations. Even in a niche which would seem, at first sight especially, to look for a symmetric treatment in the work occupying it, yet, premising that a general symmetric mass is obtained to occupy the general space of the niche, a hand and arm boldly coming forth straight out from the shoulder forwards, sideways, or upwards, and even cutting across the lines of the architecture, may have a fine, vigorous, and picturesque effect, and one still conducive to the general impression, although at first sight appearing to violate the compact of the arts. But these divergences and contrasts are only, I think, to be looked on as exceptions, and are in all cases to be guided by artistic taste alone, which is more subtle than rules. Having used the tomb of Lorenzo de Medici in its whole composition, as an instance of the pyramid, we will now apply to the central seated figure which forms the apex of the composition, for an example of the vase form, drawn together towards the vase, swelling out on either side in the centre, and contracting again at the top, as is exemplified in the engraving and the small bronze copy of the Lorenzo on the table. Michel Angelo being a proficient in all the four arts, was the more open to their combination. In regarding this remarkable tomb, if the spectator will in his mind's eye substitute for the figure of Lorenzo a vase form of similar proportions, and architectural festoons or some features of like character for the recumbent figures on either side, he will perceive how happy is the mere decorative combination as such, even apart from the nobleness of the figures; and indeed there are extant previous sketches by Michel Angelo of trials of the arrangement of these figures, in which is evidenced that their architectural arrangement in a geometric manner was his first thought. The "Premier Berceau," by De Bay, of which there is a small copy on the table, that beautiful, wild melancholy group of Eve and her Children, of which conception even the great Florentine himself might have been proud, affords another charming instance, especially in the first view of a symmetrical vase form. In these two last instances, this vase outline is not tall and taper, like that presented by the Cupid and Psyche, but is wider and more luxuriant, which is in both cases gained by a seated attitude. It cannot be denied that the general contours of both these works are in a high degree just and pleasing; and it appears to me a great pity, that in this country there seems to be a disinclination to public seated statues in picturesque attitudes. I conceive this to be a misfortune to our art at the present time. And this point may be best illustrated by viewing such works in the first place in the light of geometric decorative forms. In many situations it will be acknowledged that rather broad, full, and luxuriantly-shaped vases afford richer and more satisfactory decorations than high taper ones. In the Crystal Palace-gardens, for instance, at Sydenham, I think it will be allowed that the broad vases look better than the tall ones; and I conceive that along the upper terrace, seated figures in bold attitudes, affording picturesque light and shade, but still subserving the general decorative proportions of wide vases, would have been preferable to the standing figures adopted, especially as they would have contrasted better with the numerous

upright slender lines of the crystal edifice itself which forms their background. Seated attitudes were much adopted by the Greeks and Romans, and in later times by the Italians and French; and they have a most satisfactory effect on pedestals in the front of buildings, as would be the case in front of the Royal Exchange and the British Museum. If the authorities especially concerned in the erection of our public statues, would first take an architectonic view of the subject, and consider what class of geometric decorative form would be most harmonious in a special site, before they determined for a standing or seated figure, I think that seated figures would be more frequently executed than they are now as decorations of this city. The well-known group of the Rape of the Sabines, by John of Bologna, affords another instance of a vase-like form, round which spiral festoons of flowers may be imagined to be twisted, much as they are in those alabaster vases and flowers which we use as drawing-room decorations.

I will now pass on to busts. The ancients frequently made use of the terminal bust, and perhaps this is the most dignified way in which a work of this class can be based; but it does not so well subserve the purposes of decoration in our dwellings, and thus in modern practice has been replaced by the bust with the round pedestal. Nollekens introduced, and Chantrey continued, this mode of fitting for these works, by which means, especially when placed on the frustra of columns, they become finials of a vase-like form. Chantrey was very careful in so adjusting his busts that they should preserve a general symmetric form even at the back, fitting them well for decorations and finials, as may be, for instance, well remarked in the bust of William IV. by him, in the centre of the dais at the farther end of the hall in Greenwich Hospital. I will now proceed to offer a few remarks as to the treatment of sculpture in a tympanum. In this feature of art the general pyramidal form enforced by the space to be filled appears to be by no means the only consideration. It is unfortunate that we have no absolute record of the precise arrangement of any whole composition of Pheidias filling these spaces in the Parthenon; although in such data as remain a sort of circular form in the centre, treated in a full manner, and lessening off in waving lines towards the extreme ends, may be imagined as the general geometrical treatment entertained. It has been conjectured that the figures of Niobe and her children occupied a tympanum of a temple of Apollo and Diana; but this is not certain, nor would it be safe to deduce from this series which has been thus arbitrarily arranged, the mode of the Greeks in this feature of decoration. We have the arrangement of the Æginetan tympanum, but that is of a crude and archaic character. In illustration of my views of a fine geometric treatment for the sculpture of a tympanum, I am happy to be able to allude to an English design, which, however, I only know through the medium of the engraving before you. I allude to this beautiful design by Professor Cockerell, which you see on the walls. Now I have had no conversation with him on the subject, and I hope he will take in good part the venturesome character of my reference to his charming work; but it appears to me that this design affords a most just geometric treatment of a rich circular composition in the centre of the space occupied, tangent to the base line and to the two lines of the roof. That it thus, as it were, supports the apex of the roof, and thence runs off agreeably in diversified lines towards either end. Fancifully this treatment may be likened to the appearance of a vast mask in the centre of the tympanum, the hair of which flows off on either side to either end, like that of the Medusa; or, travestied by more common ornament, is like that of a coat of arms in the centre, and foliage branching or curling off to the extreme points of the space to be occupied. Another exceedingly picturesque example of the effective filling of a tympanum, and one very familiar, for you can hardly go up Ludgate-hill without seeing it, is on the tympanum of the west front of St. Paul's, in the relievo of the conversion of St. Paul, sculptured by Francis Bird. This appears also to have been arranged on the same principle of a circular form, opening out on all sides from the holy

radiance in the centre. It is charming in effect, and one is glad to be able to say for once something favourable for London smoke, for the mode in which it has darkened certain parts of this relievo, and left others white, has subserved the scheme of the composition, and most vigorously enhanced its chiaro scuro. As regards the arrangement of sculpture in a tympanum, there is one mode which I think one may safely say should never be adopted, viz. that which would repeat the upright lines of the columns beneath. The masonry and structure of the pediment connects and ties together the substructure; and its sculptural decoration should surely not err from this character. It appears pointed out, therefore, that the lines of the sculpture with which it is endowed should not be loose, vertical, or disconnected; but, on the other hand, should possess an agreeably interlaced character, as one composition, spreading over and combining the space from end to end, and as it were protecting all beneath like a great bird with extended wings. And following in this track, I conceive no geometric treatment arising out of this consideration to be superior to that of a richly-devised circular supporting form in the centre, carried out towards either end in waving lines. As regards the decoration of square spaces, the well-known metopes of the Parthenon evince a well-balanced covering of the surface, so as to obtain that amount of quality of light and shade that was just for the situations they occupied. But, further than this, any precise adoption of any common geometric line in them is not apparent to me. In the frieze of the same building, especially in the equestrian part of it, which will be allowed to be the finest example of the kind in existence, a horizontal ribbon-like character of geometric decoration has been adopted; the mass of the relievo, consisting of the bodies of horses and the lower portions of the riders forms the centre of this band of decoration, which is shaded off above and below with smaller forms,—above by the heads and upper portions of the riders, and below by their feet and the horses' legs. Although these details are charmingly varied, their continuity as ornament is not broken; nor, although probably the back ground was made slightly blue, do I believe that anything was done in the way of colouring that was calculated to break up this continuity. The guiding line of this frieze may be said, therefore, to be horizontal, affording an arrangement of men and horses in harmony with the principal architectural lines on the cella immediately connected with it.

We will now pass to the sculptural treatment of circular forms in relievo, and regard the geometric arrangement afforded by good examples. As illustrations of these, a very few specimens are on the walls. I have not been successful in obtaining for this purpose any shields or coins, which I should have also liked to place before you. I trust, however, to your recollection to supply the absence of these. In most of the fine examples of the occupation of circular spaces, as regards shields and metal work of that description, it will occur to you that a geometric treatment is prevalent, in which a bright light of vigorous design and workmanship is evident in the centre, raying off and shading away in intensity towards the edges. The shield of Francis I, said to be by Cellini, that of Achilles by Flaxman, and of Wellington by Stothard, also illustrate, more or less, this scheme of treatment, combined with a sort of circular movement round the outer portion, suggestive of an orrery. There appears, indeed, in art as well as in accordance with nature astronomically, an idea of movement ever connected with the occupation of circular areas of any extent. In such works as coins and gems the spaces are often too small for this feeling to arise, and, therefore, in these a single head frequently fills the centre without any lines of an undulating character around, as may be well seen in consulting the fine collection of works of this class in the British Museum. In larger works of this form of area, no finer examples are to be found than that charming pair of relievi, equally exquisite in thought and execution,—the Morning and Night of Thorwaldsen; and, in consequence, they have become standard features of architectural decoration. The same qualities, also, as fit these charming works for panels, also adapt them for gems and cameos (in which they have been worked in great numbers); that is,

their decorative character, which in a large degree results from their geometric treatment. Much more might be said on this subject as regards relievi, but my space will not allow me; and I will now, before concluding, return for a short time to works in the round, directing my remarks, however, to some features of art which I have not yet touched. The very graceful little bronze of Sappho before you, by Pradier, that Anacreon of French sculpture, is a fine example of pyramidal form attained in a single figure, fitting it, among other art-uses, for the crowning decoration for a clock; and this quality, in addition to its other excellences, has rendered it the figure most extensively adopted for those ornamental pendules which form so large a trade in France. The copyright of this figure was purchased from the artist by one house in Paris, of which I am told it has made the fortune. And it is, doubtless, in great degree, its general decorative arrangement that has made for it so great a reputation and so large a public. In other works of far larger scale, which, from their public situation, are more constantly before the eye, and which form part of the skyline of a city, and which, moreover, are liable to be regarded from a distance, whence their general outline is more recognised than their details, a geometric and well-balanced treatment is evidently still more essential. In Paris, on the column in the Place Vendôme, stands a statue of the first Napoleon, dressed in his well-known grey surtout, which, although it is not remarkable for its art, subserves its architectural purpose in a satisfactory manner as a finial of a somewhat vase-like form. This cannot be said of the statues which form the finials of two of our columns in London, which are far from being geometric or well-balanced in their general contours, and evidence, in an unfortunate degree, how very much the effect of a column may be injured by an inadequate or lopsided finial; and this may be allowed to suggest another and an additional reason to those generally advanced against the placing of portrait statues on the top of columns, inasmuch as portrait statues, especially in accordance with the prosaic taste of the present day, may be held not to allow, so well as emblematic statues do, of that quality of adjustment as would fit them best for finials. So that even on this score, if on the top of a column there must be a statue, it would appear preferable that it should be a Victory, or a Peace, or some other emblematic figure well fitted for a finial, and of which there need be no desire to see the features near, and that the portrait statue of the individual honoured should be below, in front of the base. And I would here further take the opportunity of repeating a remark that I have often made, that it would be a very beneficial rule, that no public work of sculpture of any importance should be erected in bronze or marble in this city until the full-sized plaster model had been previously set up on the pedestal, on the intended site, in order to try its effect architecturally as well as in other respects. I am convinced that, almost without exception, some advantage would accrue to the final effect of the work from this preliminary step having been taken. In the case of either bronze or marble works it is the practice always to make full-sized models in the first instance, so that but little time or delay would arise from this plan being followed. The plaster model having thus, *in situ*, received such modifications as the seeing it in its place would suggest, it would then be removed to be translated into either marble or bronze.

We will now proceed to the character of form suitable to crown a triumphal arch, for which it will be allowed probably that a flattened pyramid of decoration would be suitable, such as is supposed to have been obtained on the Arch of Constantine by a group in bronze by that emperor in a car drawn by four horses abreast. Other elements of subject than these are, of course, open to be chosen; but as regards mass and outline, as a sculptural finial, perhaps none could be devised better to enhance an architectural structure of this class than those of a flattened pyramid composed of features on not too large a scale. At Hyde Park Corner for some years has existed a remarkable instance of non-attention to these considerations, and, as I believe, is universally acknowledged, with

anything but a satisfactory effect. In this case, however, it is well known that the group was not designed by the sculptor for the place it occupies. I am unwilling to close these few remarks without availing myself of the support of some of the highest works of painting, as well as sculpture, in the evidence they afford of the dignified and satisfactory results of geometric arrangement in a sister art. As these, however, are not strictly within my province, I will merely run over the names of a few which readily occur, which will call up at once the recollection of their geometric treatment. By Raffaelle: the School of Athens; the Death of Ananias; the Madonna di San Sisto; and the Transfiguration. By Michel Angelo: the Last Judgment, and the ceiling of the Sistine Chapel. By Titian: the Assumption of the Virgin; and various works of Fra Bartolomeo and others. And there are also on the walls a few copies of fine examples which may be regarded as illustrations of this principle. Many other works will occur to you, evincing in like manner with these the views of the greatest professors of the sister art, that just geometric treatment goes hand in hand with the loftiest and grandest flights of fancy; and also which show the care taken by these masters towards the adjusting this in each case to the architectonic requirements of the situation.

In conclusion, as regards my own art, it will be evident to you that I have only touched on a portion of the subject of the geometric treatment of sculpture by reference chiefly to classic examples and Classic architecture, and not to Gothic and other styles. Nevertheless, I fear I have already too much trespassed on the light my theme is calculated to receive from the remarks of others. Perhaps, however, I may add that, apparently there is no subject that more illustrates the connection and union of the four Arts, Architecture, Painting, Sculpture, and Decoration, than that to which the above remarks apply, insomuch that it may not be inappropriate to conclude them with the well-known observation of Michel Angelo, when questioned on a collateral subject, who replied, "I know but of one art."

Mr. Parris, Visitor, believed all present would agree with Mr. Bell's remarks on the relation between Sculpture and Architecture, and their union with Painting; and he thought that concluding the paper with the words of Michael Angelo, that "he knew but of one art" was peculiarly apposite. There were strong indications now of the desire entertained by architects to combine the sister arts; and he hoped the time was near at hand when they would all be more intimately united. Had such men as Flaxman and Stothard been employed to adorn some of our edifices on a large scale, instead of being confined to the production of mere book illustrations, architectonic decoration would have obtained a vastly greater influence on the public mind. At the last meeting, when the paper on the proportions of the human figure was read, he had called attention to the fact of the same number of bones, 32, being found in each of the seven divisions of the skeleton. He had intended to point out the coincidence in the remaining examples of Greek architecture with the sub-divisions, the number of the bones, and the proportions of the human figure. The Parthenon, for instance, being 64 feet high: 64 bones formed the arm and leg;—the length being 228 feet; 224 bones constituted the human structure:—all the parts of the temple nearly coinciding with the several portions of a man 6 feet high. He thought the Greeks applied the canon thus derived from the proportions of the human figure not only to their buildings, but also to the coloring of them; frequently deviating, but never departing, from this standard. Mr. Parris referred to the advantages he had derived in his own practice, by adhering to this rule, either in drawing the figure, or in ornamental decoration; as by using the cubit of 18 inches instead of the foot of 12, there was no need to calculate, or to carry a foot rule. An exact square of 6 feet being adopted as a standard, by halving it, and again dividing it each way, the sub-division into 4 cubits high and 4 wide would be obtained. By drawing the figure on these lines, the leading proportions would be found; and by continuing to divide the squares into

equal parts or halves, a definite measure would be given for every part. The advantage of taking the cubit in preference to the foot, was that every man could find the length of the cubit by his own fore arm; the half, by the hand or span; half the span, by the middle finger; and less divisions by the thumb and the little finger. This division into two equal parts would not apply to Mediæval or Gothic structures; in which, instead of the square, the equilateral triangle was the regulating figure, and the number 3 (the Christian number) the divisor. In classic architectural decoration he would adhere to even numbers, as two and its multiples; but in all other styles, he would work with the number three.

Mr. Donaldson, H.S.F.C., said that in this country architects were forced to consider a building complete without sculpture; in fact, however, sculpture was necessary to give to every building its proper intensity of feeling. Among the ancients there never was a temple, however humble, without sculpture. This was found to be the case also in the Choragic monuments, and in the simplest tombs. Modern French architects carried out the same principle, and employed sculpture most lavishly, as might be seen in the new works at the Louvre. These sculptures were neither ordinary nor common-place, but the first artists of the country were engaged upon them. With regard to grouping sculpture in a vase-like form, Serlio imagined that the outlines of all vases were based upon the primary type of an oval, loftier or wider in different examples. He did not know whether Mr. Bell would adhere to the term "vase-form," or whether he would accept "the oval." A group of oval composition might incline one way or the other, but a vase must always be vertical; because the inclination of an oval would not deprive it of its stability, which a vase could not have when not vertical. The vase was an important feature in connection with architecture, for the architect was often obliged to introduce it where, did not the expense prevent him, he would have figures or groups of sculpture. The figures in the Niobe group appeared to combine themselves very satisfactorily in the pyramidal or tympanum form, as shewn in a beautiful drawing of the composition, arranged by his friend Mr. Cockerell. The tympanum of St. George's Hall, Liverpool, was a very fine modern example. One great law to be observed in all sculptural compositions for pediments was, that the figures should be as large as possible, otherwise they would not play their part in the grand and entire whole, as in the pediments of the Parthenon. Mr. Bell had alluded to the impropriety of carrying the vertical lines of the columns into the pediment. Another great error might be noticed in the pediment of the Madelaine at Paris, the modillions above the tympanum being so arranged that the light falling upon them gave them the appearance of so many more heads of figures in addition to the sculpture beneath, while the breadth of light upon the tympanum itself was greatly interfered with. The geometric treatment of sculpture had forcibly struck him when looking at Michael Angelo's works at Florence, when it appeared to him that the figure might be confined within four lines,—two vertical and two horizontal,—these lines all touching the prominent parts of the figure and its pedestal. The same squareness of composition was found in the other works of Michael Angelo, such as the figures of the Prophets, in which the parallelogram seemed to prevail over the vase form. Perhaps this great sculptor might have been guided by his feeling for geometry, connected with his knowledge of architecture. At all events, architects were greatly indebted to him for many grand and noble features, particularly his alteration of Bramante's design for St. Peter's; in which, despite the badness of the detail, the effect was very fine and grand; indeed, the style of Michael Angelo was as *grandiose* in architecture as it was in sculpture. Another painter who had treated decoration architecturally was Domenichino, whose skill was displayed in the four pendentives of the church Della Valle at Rome, as well as in those of St. Peter's; and fortunate indeed was the architect in whose behalf his services had been enlisted.

Mr. Bonomi, Visitor, said the pyramidal outline applied to sculpture had long ago been noticed,

but Mr. Bell was the first to suggest the vase-form, which, as he had stated, might be exceedingly varied in its proportion, and either wide or tall in different examples.

Mr. KERR, Fellow, whilst fully appreciating the manner in which Mr. Bell had brought the subject before the meeting, must dissent from the apparently received doctrine that there was no canon of taste, and that art was an intangible and inappreciable thing. He considered the object, for which they as artists, as scientific men, and as a body of human inquirers met, was to discover the scientific laws of nature. It might be objected that art was not nature, and when he asserted that art had its principles, it would perhaps be said that nature might have scientific principles, but art had not. If it had been announced in bygone days that there was no canon of gravitation (the laws which were now so completely understood), the announcement would have been received as readily as the assertion now that there was no canon of beauty. Whilst, however, Mr. Bell and other gentlemen denied the existence of a canon of beauty, they had experimentally pointed out that there was such a canon, whether in the "vase form," or in the "oval." It had been stated that artists had no principles to guide them in producing beauty, but that they had really been working by accident. The works of artists were to be considered as a collection of accidental successes, and failures, but if *a posteriori* reasoning were applied to the great mass of artistic endeavours, they would discover there was always something which pleased, and pleased by system,—that there was in fact something which they called beauty. Whether they could discover *what* it was, was another question. Besides the art already referred to, there were others whose principles were worthy of investigation,—poetry, and music. The poet might say he was no better off than the painter; that he had no canon, and that he worked by chance; but the musician would state quite the reverse. His art was science of the most exact kind. Now the essence of musical excellence was arithmetical proportion, and arithmetical proportion applied to architecture (as was the custom in the old fashioned classical days, before Gothic came in and upset the practice) would give a canon available to a certain extent; for at present they were only on the threshold of the subject. Arithmetical proportion was to be found in Mr. Bell's "vase form," which, instead of having straight pyramidal, had curved pyramidal sides, so constructed with reference to the vertical line that the centre of gravity of the two sides should appear exactly balanced. As Mr. Donaldson observed, Michael Angelo had repudiated mere graceful forms, and adopted a square, solid, and substantial idea, and Mr. Donaldson bore undeniable evidence to the presence, in those monuments, of the perfection of balance so essential to sculpture. In the present day Gothic ideas were prevalent, but he hoped the time would come when the student would attend more to arithmetical proportion, for he thought that studies so directed would be productive of excellent results.

Mr. CHARLES BARRY, Fellow, had listened with great interest to the mode in which Mr. Bell had brought forward the subject of harmony of line, proportion, and balance, matters which, as architects, they were accustomed to consider in their own profession. He had been much informed by the mode in which Mr. Bell had shown that forms which they would consider simply architectural and decorative, might be found running through all the compositions of the best ancient and modern sculptors. The remarks on the treatment of statues in public places, and even in private gardens, were of much value. An architect had many difficulties in the employment of sculpture. The principal were the costly character of statues, and the want of cordiality between architects and sculptors, who too often forgot the dictum of Michael Angelo, that there was but one art, which they must all nevertheless feel to be sound reasoning and good sense.

Mr. KERR referred to the cost of sculpture. Some years ago he noticed that it was much more generally employed in Edinburgh than in London, and he was informed by Mr. Ritchie that a full-sized figure in the free-stone of that locality could be produced for £50.

Mr. C. H. Smith, H.M., and Mr. Bell, gave some explanation from their own practice:

The money value was that of the time taken to make the model, the outlay for material, workmen's wages, studio, &c., but the question would of course be, what the artist ought to receive in addition for his skill and time spent in twenty or thirty years study. Mr. Bell thought cent. per cent. on the outlay should be allowed the sculptor. For two marble statues in St. Stephen's Hall, Westminster, he had received £1000. each, one-half of which he considered had been the amount of outlay.

Mr. M. Digby Wyatt, Hon. Sec., considered Mr. Kerr's to be a practical question, and would be glad to hear of any means by which cheap and good architectural sculpture might be obtained. Every architect seeking to carry his art to perfection can only succeed by the aid of painting and sculpture. Those arts were especially valuable, not alone from their extreme beauty, but because architecture was defective, since a building of perfect proportions might be erected, but without either painting or sculpture, the precise purpose and the thoughts connected with it could not be expressed. To stamp them upon any structure the "phonetic element," as Mr. Fergusson called it (in his admirable "Essay on Beauty"), must be superadded. The sculpture of the Parthenon, the statues in St. Stephen's Hall, the mosaics of Orvieto, and the frescoes of the Campo Santo, expressed the purpose of the respective buildings they adorned in a manner which abstract conventional forms alone could never do. In making use, however, of the resources available through the sister arts the architect should draw the curb tightly, otherwise, poor Britons! in inviting these Saxons to help them, they might find their legitimate functions annulled, and wild discord suffered to reign where order, harmony and beauty should be the presiding deities. The best way for architects to exercise this check was to deal with the works of the painter and sculptor as abstract decorative adjuncts, irrespective of their ideal characteristics, and as intended primarily to enhance the strictly conventional forms of the architecture. Sculpture, as Mr. Bell had incidentally mentioned, might be made to subserve these ends by three principal elements, viz. contour, mass, and light and shade. Upon a due subordination of these to each other, and to the structure they embellish, the good effect of architectural sculptures must depend. In very low relief, contour was the most important point, but the moment the artist adopted a higher degree of relief, the second element, or mass, became most essential; because then not only the lines touching the ground, but the proportions of mass rising to certain planes, must be harmonious; and each successive plane must obey the original laws of beauty which made the well-designed contour graceful in low relief. Not only should the masses balance in general quantity, but the amount of cutting up of each mass should be equivalent one to the other where they were responsive. Care must be taken to keep the balance even; thus in designing sculpture for a tympanum, for which very high relief might be preferable in order that the leading forms might be well illuminated, if the surface of the sculpture on one side the central axis were cut into holes or notches (for diapers, draperies, &c.) a quantity of black spots upon the white would be introduced, giving to the work a grayish tone, and more dark than light would be given to one side. If the sculpture of the other half were left with a smooth surface, it would hold a much greater quantity of light, and would draw the eye towards it, whilst the darker half would not attract the eye at all; and thus, notwithstanding the general arrangement might be symmetrical and good, through a disregard of the laws of chiaro-oscuro, failure in effect might result. Hence it was essential that the artist should learn how to trace contours, how to distribute masses, and how to deal with the lights and shades of his composition. In looking at the symmetry of a beautifully-designed piece of sculpture, whether in the round or in any degree of relief, the experienced eye could not fail to recognize that balance and regularity, not too slavishly sustained, were all important. A design might be vase-like or of any other form, it was only necessary that it should be simple, well balanced and

symmetrical; and whilst symmetry should be carefully preserved, it was at the same time necessary to veil it, and prevent its being left too apparent. The principle of the central group of Professor Cockerell's beautiful pediment at St. George's Hall, Liverpool, which Mr. Bell had described as based on the circle, would have been objectionable if the fundamental form had been too distinctly shewn; but the moment the impression of regularity of form was obtained, combined with that variety which was incessant in nature, the effect was complete and satisfactory. Mr. Wyatt proceeded to point out various geometric figures suitable as bases for the design of sculpture to fill triangular compartments, observing that no one line ever comes across or in contact with another without affecting it either agreeably or disagreeably. Therefore in a pediment it was essential to have such lines as should assure the eye that the corona retained its horizontality, and the sloping sides of the tympanum their truth of line and relative balance of angle. With respect to circular designs, such as shields, Mr. Wyatt illustrated a few of the principles which should govern them, by sketches upon the black board. He shewed that if lines diverging spirally from a centre gave to the design the appearance of a wheel in motion, that appearance of motion might be at once arrested by an outer circle of lines diverging in a contrary direction. This shewed the simple action of one line, or set of lines, upon another, and proved how essential it was for repose to bound all lines spreading into movement by lines quiescent in their own character, or in reverse action.

Mr. Bell, in acknowledging the thanks which had been voted to him, said he felt the complete truth of Mr. Wyatt's last remarks, and although he had not arrived himself at the full treatment of circular forms, he readily adopted it. He concurred with Mr. Donaldson that the square as well as the vase form might be noticed in the figures by Michael Angelo.

The meeting then adjourned.

ON THE RECENT IMPROVEMENTS IN PARIS.

By Edward I'Anson, Fellow. Read at the Royal Institute of British Architects, Jan. 10th, 1859.

Although Paris is well known to most of us, it has occurred to me that a general account of the great works which have recently been carried out in that city may still be interesting. Much has been done since the cessation of Napoleon Buonaparte's wars to improve the principal towns throughout Europe. In London, for instance, immense and thickly-populated districts have sprung up; but Paris has changed in another manner, and on all sides of it buildings of great importance for their magnitude, and of the highest interest as works of art, have been erected. Thirty years ago the magnificent Place Louis XV. was a vast plain of mud in Winter, and of shifting sand in Summer; and the ground now occupied by the new works of the Tuileries and of the Louvre was encumbered with irregular streets of closely-packed houses, booths, and mean shops. The colossal works begun by Napoleon the First, the Arc de l'Etoile, and the Church of the Madeleine, were still surrounded by scaffolding; and the massive Fountain of the Elephant on the Place de la Bastille, a project since abandoned, was only a model in plaster. Some great works, however, had been done,—the Pantheon, some of the bridges, the column on the Place Vendôme, and the Rue de Rivoli had been commenced. With these exceptions, Paris could not then have materially changed in aspect since the time of Louis the XIVth. Scaffolding still masked these works in 1830, when Louis Philippe became King; by whom, after a time, the completion of the public monuments was taken in hand, and measures, I believe, were contemplated for extensive municipal improvements. Despite some incongruities, he had a very grand town to deal with, containing features which marked it as a monumental city as well as a great metropolis. Among the works undertaken by him was the completion of the Arc de l'Etoile, which had been commenced in 1806, after the Battle of Austerlitz. The work was confided to M. Blouet, and vigorously carried on till its completion in 1836, at the cost of £417,812. The central archway is 90 French feet high by 45 feet wide; the total height of the monument is 152 (162 English) feet, and the breadth and depth are respectively 137 (148) feet by 68 (72) feet. The whole is impressive chiefly on account of its colossal proportions, and the mass and solidity of its parts. In addition to some noble colossal sculpture, it is covered with the names of the warriors who accompanied Napoleon Buonaparte in his various campaigns, and of the battles in which they were triumphant. On reading them the beholder is impressed with the conviction that the names graven on a monument so grand and durable will defy both the destructive power of man and the slow decay of ages, and pass down in honour to the remotest time. The Church of the Madeleine was finished under Louis Philippe by the architects Vignon and Huvé. This building is also of great dimensions, being 328 English feet in length by 128 feet in breadth. The cost amounted to £523,160. The podium supporting the columns, which are nearly 50 feet high, rises 12 ft. 9 above the pavement. The general plan is that of a peripteral temple, with an octastyle portico. The effect of the exterior is imposing, but it is far from being a refined work of art: the mouldings and the proportions of the various parts being generally coarse and common-place. The frieze is decorated with sculpture; but the usual right line at the angle being broken by the continuation of the enrichment, a singularly weak and disconnected appearance is given to the profile of the entablature when seen anglewise. The figures placed in the niches between the columns round the cella are but indifferent works, but the detail of the doors and architrave of the principal entrance is of exquisite beauty. The flowing ornament on the architrave is of thoroughly French renaissance character, executed with delicacy and breadth hardly attained by the cinque cento artists; and it is

moreover a remarkably fine specimen of casting. The doors and architrave, which are, I believe, of bronze, were designed by Triquetti, and cast by Richard Eck and Durand. The doors are only inferior in size to those of Saint Peter's at Rome. The interior is to my mind more satisfactory than the exterior, though it is not in congruity with it, as it consists of three square compartments, each covered by a dome with openings for light. This plan is not that to which we are accustomed in a Christian church; it is neither Basilican nor Cathedral; nor does it, as I have said, correspond with the external features of the building. The effect however is rich and grand, and some of the minutiæ are beautiful; as the metal railings to the chapels, the baptismal font, and the organ case.

One of the first works of the reign of Louis Philippe was the great column of the Place de Juillet, built, as its name implies, in commemoration of the three days of July 1830. It consists of a column of bronze, raised on a plinth of masonry; a bronze figure crowns the whole, and brings the total height to 160 feet, English. The total weight of bronze used amounted to very nearly 407,000 lbs.

The Ecole des Beaux Arts, begun in 1832 by Debret, was carried on by Duban. It contains one of the best modern frescoes, or rather wall paintings, by Paul De La Roche, for which he received £3,200. The building cost £140,600. The Conservatoire des Arts et Métiers, for which, in 1846, a sum of £57,618. was voted, was commenced under the direction of Lèon Vaudoyer, Architect. The Church of Notre Dame de Lorette, begun in 1823 by Lebas, was completed; but the beautiful fresco decorations of the interior have been added more recently. The total cost of this building is said to have been about 1,800,000 francs.* One year later the still larger church of St. Vincent de Paul was begun from designs by MM. Lepère and Hittorf: it is remarkable for the introduction of polychromatic and profuse mural decoration, of stained glass windows, &c. at a cost of 256,300 francs. The enlargement of the Palais du Luxembourg was carried out at a cost of £120,000. The character of the exterior of the old part by De Brosse was studiously preserved by the architect M. Gisors. In 1836 the Municipality commenced the embellishment of the Place de la Concorde, and of the Champs Elysées. In 1836 the Luxor Obelisk was also erected in the centre of the Place de la Concorde, having been transported from Egypt, and fixed at a total expence stated to be about two millions of francs. In 1844 the Fontaine Molière was erected from designs by Visconti, and subsequently an elegant fountain on the Place Louvois. In 1845 very important works, although not absolutely in Paris, namely, considerable additions to the Lunatic Asylum at Charenton, were completed under M. Gilbert, Architect, at a cost of £132,800. About this time M. Hittorf erected, in the Champs Elysées, a Circus, peculiarly well suited to its purpose. I may also mention the elegant façade of a small theatre on the Boulevard du Temple, now the Théâtre Historique, but then the Théâtre Montpensier. Another work begun by Louis Philippe is the Church of Sainte Clotilde, erected in memory of his youngest daughter. He also built on the spot where his eldest son the Duke of Orleans met his melancholy death a small chapel, dedicated to Saint Ferdinand. The architects employed were Messrs. Lefranc and Fontaine, who erected a work very inferior to anything, I think, our revived Mediæval tastes would have erected even at that time. It is however principally remarkable for the scenic effect of the interior, produced by the skilful grouping of sculpture and painting, and the management of the light: amongst the sculpture is a representation of a kneeling Angel, the work of his deceased sister Marie, who little thought, when she wrought it, on whose tomb it would be placed. The fortifications of Paris, begun in 1841, are said to have cost £5,650,000. Ten distinct forts are included in the circuit of the

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* The French metre = 3·28 English feet. The Paris foot = 1·066 English foot. 1,000,000 francs = £ 40,000. English money.

walls. In 1848 the Mairie of the third arrondissement was begun, and in 1851, the Mairie of the eleventh arrondissement was built. In 1850, the fine building of the Bibliothèque Sainte Geneviève was completed, after being in progress about six years. M. Labrouste was the architect; the cost, exclusive of architect's charges, was 1,569,000 francs. About the same time the very fine and original building, the Timbre Imperial, was completed, at a cost of 1,298,000 francs.

Louis Napoleon, soon after his election as Emperor in 1852, turned his attention to the public works, and since that date the progress of building in Paris has been beyond all precedent, even of the times of Imperial Rome.

I will now proceed to notice briefly the buildings commenced or built during the last six years. Among the early works of Louis Napoleon was the tomb of the Emperor Napoleon I, designed by Visconti, and erected under the dome of the Invalides. It is much enriched with appropriate sculpture, and cost £360,000.

In the early part of 1852, so great was the impulse given to public works, that the following were in progress. The completion of the tomb of Napoleon Buonaparte; the Hospital du Nord, Clos St. Lazare; the Nouveau Ministère des Affaires Etrangères, begun in 1845, completed a year or two later, at a total cost of £200,000.; the works at the Tuileries; the interior decoration of the Hôtel de Ville, and of the Church of Saint Eustache; the restoration of Notre Dame; the enlargement of the Polytechnic School; the continuation of the Rue de Rivoli to the Rue St. Antoine; the restoration of the Pont Neuf; the completion of the Quai Conti and part of the Quai Malaquais; the Station of the Chemin de fer de l'ouest; the new Entrance to the Luxembourg Gardens; the embellishment of the Champs Elysées; the enlargement of the Railway Station, Place de l'Europe; the enlargement and decoration of the Palais de Justice; the construction of a Mairie for the fourth Arrondissement; Infantry Barracks, Rue Notre Dame des Victories; the Works of the Halle Centrale; the enlargement of the Rue Montmartre, Mathurins, Saint Jacques, Sainte Avoye, De la Harpe, and others; the formation of the Rue des Ecoles; the transferring of the Garde Meuble to the Ile des Cygnes; the completion and decoration of the Church of Ste. Clotilde; the Place Belle Chasse; the continuation of the Works at the Louvre, and at the Chemin de fer de Ceinture; several Kilometres of Sewers; with the improvement of various Hospitals and Prisons. In the same year, 1852, the Library of the Conservatoire des Arts et Metiers was opened; and it was decided to erect a Crystal Palace in the Champs Elysées, a work accomplished in the year 1855;* the Boulevard de Strasbourg, leading from the Railway Station to the general line of Boulevards, was opened, the length being nearly 1093 yards and the breadth 105 feet; the restoration of the Louvre and its reunion with the Tuileries were begun; the Mairie of the third Arrondissement, begun in 1848, was finished; and the Jews' Hospital was opened.

In 1853, the decoration of the chief Apartments in the Hôtel de Ville was completed; the Jews' Hospital, by A. Thierry, was completed, at a cost of 400,000 francs; the Palais Royal was entirely restored for occupation by Prince Jerome and Prince Napoleon Buonaparte; the Works at Notre Dame were recommenced; extensive Works and additions at the Bank of France were commenced; the East Works at the Docks† Napoleon were partially finished; the Hospital Lariboisière, begun under Louis Philippe, containing 612 beds, M. Panthier, architect, (cost eight millions francs,) was opened; the Iron Pipes to convey the Water from the Reservoir at Chaillot were being laid in the

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* The surface utilized, including all annexed buildings, was computed to amount to 124,804 metres. The area of the building in Hyde Park was about 72,000 metres.

† The works are still in progress; during the last twelve years a sum has been expended on them of 22,000,000 francs.

Bois de Boulogne, the lake of nearly ten acres area was almost finished; an Iron Enclosure was erected at the Hôtel des Invalides, with two new Lodges, and the façade of the Church was repaired.

In 1854, the Works at the Caserne des Petits Pères were recommenced; extensive restoration and repairs of the exterior and the interior were begun at the Palais de Justice, the houses which surrounded the building on the West and on the South having been removed; the Bridge of Austerlitz, built of iron in 1830, being much out of repair, was rebuilt of masonry in the space of three months, at a cost under £38,000.; and the very beautiful Building, the Cirque Napoleon, was erected by M. Hittorf, in the short space of nine months, at a cost of £27,000.

In 1855, a new Municipal building covering a superfices of 1500 metres was commenced at an estimated cost of 627,043 francs, by M. Baltard, architect. The works and additions at the Bank of France were terminated; the additions by M. Gabriel Cretin, architect, costing £80,000. and covering a space of 9750 feet; and the restoration of the tower of St. Jacques, was completed at a cost of £40,000. in addition to £10,000. for purchasing it. In 1856, the removal of the sheds and buildings surrounding the Palais des Thermes was in progress; the Municipality voted the funds for re-constructing the Prefecture of Police, under Messrs. Gilbert and Diet; the Gothic Church of Sainte Eugenie, M. Boileau architect, was completed; the Pavilions of the new Louvre were covered with scaffolding, newly erected, in order to execute further decorations; the covered ways of the Halle Centrale were finished; the vast space comprised between the Place du Louvre, St. Germain l'Auxerrois, the Quai de l'Ecole, the Rue de l'Arbre Sec, and des fossés St. Germain, was cleared away and laid out; the buildings for the Manutention Militaire were finished; the new wing of the Ecole Militaire was in progress; the Pont de Jena was decorated with four equestrian statues; the decoration of the Pont des Invalides was completed; and the buildings about the Church of Saint Eustache had been entirely removed. In 1857, the Church of Sainte Clotilde, M. Gau architect, begun in 1846, was completed; the Garden round the Ruine des Thermes and Hôtel de Cluny was enclosed by an iron railing; and the additional works at the Hôtel de la Monnaie built in 1768, were finished. The following works were in progress:—The Boulevard de Sevastopol, which then extended from the Strasburg Station to the Rue d'Ecole de la Madeleine; the Boulevard du Prince Eugene between the Barrière Poissonière and the Boulevard du Temple; and the demolitions on the left bank of the Seine for the Boulevard from that of Sevastopol to the Jardin des Plantes; the vast Caserne du Chateau d'Eau on the Boulevard St. Martin; the picturesque promenade or square of the Quartier du Temple; and the works of the new Louvre were completed. The Fontaine du Palmier was removed bodily, and placed centrally upon the new Boulevard de Sevastopol. Very extensive restorations and some new works were in progress at the Bibliothèque Imperiale, giving it quite a new character, and reviving a style of architecture with red brick facings and stone dressings, which seems at present rather in vogue in Paris, and which M. Labrouste, the architect to these restorations, has successfully applied in an hotel built for M. Achille Fould. The demolition of the old and construction of the new Bridge of Saint Michel; and also a temporary bridge undertaken, like the removal of the Fontaine du Palmier, as part of the works of the Boulevard de Sevastopol. In 1857, the Church of Sainte Eugenie, M. Boileau architect, was completed. It is built of stone and iron, and exemplifies the great difficulty of satisfactorily combining these materials. The mullions and trefoils of the windows are meagre, and yet not sharp; the effect of the internal columns is poor and without elegance, and the interior generally recalls to mind the interior of a railway station rather than of an ecclesiastical building. The internal light is however well managed, as is also the iron construction of the roof. In the same year, the south façade of Notre Dame was entirely restored, the apse had been repaired, and the restoration of the north façade was in progress; the restoration of the roof and the upper part of the Sainte Chapelle externally were finished, and the works

were proceeding in the interior; the Churches at Villette and Vaugirard had been built, and that at Belleville was in progress; the Hospice, founded by the Empress, for the reception of poor girls, near the Barrière du Trône, was finished, M. Hittorf architect; the two Hôtels des Invalides Civils, one in the Bois de Vincennes for convalescents, the other in the Forest of Vesinet for mutilated workmen, were finished; the Chambre des Notaires was removed to make room for the Boulevard de Sevastopol, and rebuilt on the Place du Châtelet; the Pont des Invalides, of four arches, situated on the site of the suspension bridge, built in 1829, was finished, at a cost of £32,000.; and the Pont de l'Alma, of two flat arches, commenced in 1836, was completed.

In 1858, the Boulevard de Sevastopol was opened; the remodelling of the Garden of the Tuileries, a work, I believe, still in progress, was commenced; the Bridge of the Legion of Honour was commenced; the Column on the Place de Breteuil was inaugurated, and the Pont du Change demolished; the great Barracks at the Chateau d'Eau opened; and the Hospice des Ménages, Rue de Sèvres (proposed to be rebuilt at Issy), removed. Amongst public works now contemplated, I find—the removal of the great Hospitals; the formation of an Acqueduct from near Epernay to Paris, at a cost of upwards of £428,000.; the formation of a new system of sewerage, at an estimated expense of £140,000.; a central tower to the Church of Notre Dame; and the removal of the Institution of Sainte Perine at Chaillot. The remarkable building called the Halle Centrale deserves a special notice: it comprises ten different compartments in two sections, separated by a boulevard 30 metres wide; the first section occupying 20,000 and the second 10,000 superficial metres. Cellars extend under the whole, which it was intended should be connected with the railways entering Paris, by means of underground railways on the line of Boulevard de Strasbourg and du Centre; but this project has been abandoned. Iron, cast and wrought, glass, and brick, are the materials used. The arcades of the front measure six metres in width: the lower part is enclosed with brickwork; above is open glass work, and the upper part has fixed glass work. The employment of cast iron is here quite legitimate, and pleasing in effect. The columns are light and elegant, interfering neither with space, light, nor air, more than is consistent with solidity, in which respect the whole composition is wanting neither in reality nor in appearance. In November, 1857, the works of the first part were on the point of being completed, the large tables of white marble being placed in the fish market. The expence of obtaining the land and houses for the Halle Centrale, was estimated at 9,141,020 francs, and it required the demolition of 106 properties, occupying a space of 13,262 metres. The construction, with the compensation, and the enlargement of the adjoining streets, cost £1,572,000.; of which the houses pulled down cost £1,080,000. I must also refer to those essentially modern works, the Railway Stations: one of which, the Strasburg Station, appears to be a model for such buildings. The others are the Rouen railway station, covering a space of 43,000 metres; the Chemin de Nord, covering 44,000 metres; the Lyons, covering 60,000 metres; the Orléans, covering 46,000 metres; the Sceaux and Orsay, covering 9,000 metres; and the Chemin de l'Ouest station, covering 24,000 metres. This last named has an iron roof 120 metres long and thirty metres span, the total weight of which is 317,955,88 lbs. The Strasbourg railway station, in the Faubourg Poissonnière, the work of M. Lermet engineer, and of Mr. Duquesney, architect, was commenced in 1847, and finished in 1852, at the cost of the State. It covers 53,000 metres.

The cost for the ground	6,000,000	francs.
Earthwork and works of art	1,900,000	„
The Station	2,900,000	„
Total ..	10,800,000	„

The length of the façade is 165 feet. The convenient arrangement of the Place in front (which is

also found in most of the stations in Paris) deserves especial mention. A spacious court yard, surrounded with iron railings, affords ample room for carriages both coming and going. The building, as a work of art, is of the highest order, and its purpose and use are at once apparent. The roof of the station is very ingeniously and beautifully constructed; it is not perhaps so grand and simple as that of the Great Northern Railway in London, nor so fanciful as that of the Great Western, but it is certainly not inferior in merit to either. I may also mention, as one of the most characteristic features of Paris, the number of trees which line the great thoroughfares of the boulevards and surround some of the public buildings. Their green colour forms a great relief to the general hue of the masonry; it diversifies the prospect by pleasing masses of light and shade contrasting with the severer lines of the architecture, and gives freshness, coolness, and pleasing variety. In the particular of trees much has been lately done, and instead of waiting for that slow growth by which they would increase, noble trees of twenty years at the very least are planted; thus round the Bourse I last year noticed, that all the old ones, which had flourished but ill in the locality, had been replaced by stately trees of ample size, and that in order to preserve them until their roots should get firm hold in the soil, they were swaddled round with woollen bandages, metal hopper-shaped receivers being placed at the upper part of the stem to receive and distribute the water applied to the trunk, kept in a constant state of moisture by means of the woollen wrapper. The new Boulevard de Sevastopol is planted thus with fine full grown trees, and especial care has been taken with those round the Fontaine du Palmier. The subject of trees leads me also to notice the Bois de Boulogne, and the great works which have there been carried out. This park, which was formerly in a thoroughly neglected condition, was about 1853, handed over to the town, on condition that improvements should be made. The first operation was to conduct the necessary water supply to form the decorative lakes. The pump at Chaillot furnishes the supply from the Seine by means of a tube 40 c. (16 in.) diameter and 3740 yards long, there are also branch pipes in all directions for watering plants, the roads, trees, &c. In 1854, at least 6,200 metres of these smaller pipes had been laid, at a cost of £ 4,000.; one lake contains 30,000 cubic metres of water, and the other and larger one covering an area of 110,000 metres, holds 150,000 cubic metres of water. The level of one lake is considerably above that of the other, so that a waterfall of very good effect is managed on the rocky sides which line the lower one, and for three or four hours during the time of promenade, there is a very considerable fall of water. There are many ornamental buildings, lodges, and Swiss cottages. The turf and road are beautifully kept; and the plants and shrubs, many of them of rare kinds, are in excellent order.

Having given a sketch of the several buildings erected of late years in Paris, it may be interesting to record the cost of some of them, this I have already done to some extent, but I will now quote the following:—

The Jewish Church, by M. Thierry		234,294	francs,
Jews' Hospital, same architect ...	Ground 65,000		
	Building 96,492		
		161,492	„
Cost of Building about 80 francs the square metre.			
Mairie, 3rd Arrondissement		389,379	„
New Fourrière, or Pound for the Police		207,752	„
140 francs the metre.			
No. 60, Boulevard de Strasbourg, private house		203,332	„
651 francs the metre, probably including land.			
New Wing, Lunatic Asylum, Charenton		3,320,000	„

As more detailed examples, I give the expenses of three buildings, namely, the Circus by Hittorf; the Colonne de Juillet, and a house, Place St. George.

The Circus built by M. Hittorf, on the Boulevard des Filles du Calvaire.

	francs.
Masonry	194,000
Carpentry	58,000
Ironmongery	62,500
Founder	15,000
Joiner	93,000
Carving	37,500
Stoves	8,000
Paving and Asphalte	16,500
Stucco Work	2,000
Painting and Gilding	24,500
Ornamental Sculpture	16,000
Bronze Ornaments	16,000
Painted Windows	2,500
Furniture	20,000
Lustres and Gas	42,000
Decorative Painting	6,500
Historical Painting	10,000
Statuary	20,000
	644,000
Design & direction ...	32,000
Total	676,000

or £ 27,040.

The total surface covered by construction being about 1,900 metres, the cost per metre amounts to about 350 francs.

The Colonne de Juillet was estimated to cost 1,172,000 francs, nearly £ 47,000. The heavier parts of the bronze work was paid for at the rate of 3 francs 75 c. the kilogramme (2.2 avoirdupois), and the lighter parts at the rate of 4 f. 25 c.

The house, No. 26, Place St. George, built in 1853, and occupying a space of 1,307 square metres, cost 564,000 francs, being at the rate 448 f. 80 c. a metre for the ground. The building covers 823 square metres, being at the rate of 237 f. 35 c. a metre. The cost of the works under the several heads was as follows:—

	francs.
Masonry	150,000
Carpentry	40,000
Joinery	50,000
Ironmonger, Smith, and Founder	33,000
Covering and Plumber ...	10,000
Paving and Glazing	18,000
Gilding	8,000
Paper Hanging	2,500
Internal Mirrors	11,000
Plate Glass, externally	7,000
Stoves	4,000
Sculptor	13,000
Carton pierre	3,500
Pavement	4,000
	534,000
Interest on outlay, and architect's commission	30,000
Total	564,000

or £ 22,560.

The income is said on a moderate scale of letting, varying from 900 francs for a fourth floor towards the Rue Laferriere, to 6,200 francs for a first floor on the Place Saint George, with stabling for two horses, to have realized 39,500 francs, or at about the rate of 7 per cent. on the outlay.

Together with the great public buildings recently erected, and more particularly the junction of the Louvre and the Tuileries, the cost of which has been laid before you on a previous occasion, the most important public works which distinguish the era of Napoleon the Third, are the very striking improvements which have been made in some of the public thoroughfares of Paris, and which, in fact, give a perfectly new character to a great part of the town. The most remarkable, if not the most important, is the Eastward continuation of the Rue de Rivoli from the extremity of the garden of the Tuileries to the Place du Louvre, a length of 1,300 metres (33,992 feet); and numerous cross streets running North and South have been carried out at the same time.

Up to the end of the year 1857 the works on the Rue de Rivoli had cost £4,800,000., and caused the demolition of 800 houses. As part of this work may be also mentioned the Square of St. Jaques, and the Avenue Victoria in front of the Hôtel de Ville, at the back of which is now being built, as a pendant to St. Germain l'Auxerrois, a Mairie for the fourth arrondissement. This square occupies a superficas of 6000 metres. The trees and shrubs are of new, rare, and valuable kinds, and were obtained from the first nurseries of Paris, Angers, and Nantes. After the Rue de Rivoli, the most important new street is the Boulevard de Sevastopol, commencing at the Strasburg Station and extending thence to the Boulevard St. Denis, and passing between the Rue St. Martin and the Rue St. Denis; it then assumes the distinctive name of Boulevard de Sevastopol, and continues until it reaches the Seine at the Place du Châtelet. Up to this point the expense is said to have been about £320,000. It is intended to carry this boulevard across the Ile de la Cité, and on the other side of the Seine from the Quai St. Michel up to the Hôtel de Cluny. According to the indication furnished by a recent map it would appear that the work will be continued as far as the end of the Boulevard de Mont Parnasse; its length from the Strasburg Station to the Barrière d'Enfer is 6000 metres. An offset from the Boulevard de Sevastopol is the Rue des Ecoles, leading to the Halle aux Vins, it was commenced in 1857; the assumed cost of this street is five million francs. On the north side of the Seine, from the newly constructed Caserne of the Chateau d'Eau as a centre, three streets are contemplated; the Boulevard du Nord to the Barrière Poissonnière; the second to the Barrière du Trône; and the third to connect the Halle Centrale with the Faubourg du Temple. A number of new streets have been formed in the quarter between the Rue Saint Lazare, Rue de Clichy, and Rue des Martyrs, a part occupied a few years ago by gardens and occasional houses. In 1847 a new street was opened in the immediate vicinity of the Bank, in which the fine building of the Timbre Imperial was erected, as also the Mairie of the 3d Arrondissement. A new street has, I believe, been begun from the Place Malesherbes to the Place de Laborde; other streets have, I know, been formed, particularly towards the Champs Elysées in the neighbourhood of the Elysée Bourbon. Among important projected works may be mentioned a Place by M. Hittorf at the Arc de l'Etoile, the Avenue of Neuilly being enlarged to 180 metres. Turning again to the South side of the river, we find a new Boulevard running between the Boulevard de Sevastopol and the Quai S. Bernard; the enlargement of the Rue Four St. Germain; the rectification of the Place St. Marguerite and du Carrefour de la Croix Rouge. The expense of the work was valued at £88,800. The Boulevard St. Marie to be made in three sections, from the Rue Royale to the Boulevard de l'Hôpital. Another improvement will be the widening of the Rue Mouffetard; besides which I see two other great lines of street are traced. I have now only mentioned the most recent streets of Paris or those in immediate contemplation; but there are other works of the last thirty years, such as the annexation of the Ile des Cygnes to the adjoining land, the Boulevard Mazas, and the Rue Lafayette, which are of very considerable importance.

In order to form these new streets, the law under which expropriation, that is compulsory sale, takes place was passed as it now stands on the 3rd of May, 1841. It has been completed or supplemented by several regulative ordinances and by a decree of the Pouvoir Executif, having all the force of law. The expropriation takes place on the report of local commissioners, and the compensation is assessed by a jury who sit as judges of the value. The whole of this subject will be found rather fully treated of in the 198th and 199th numbers of the "Journal of the Society of Arts;" for the year 1856; but the fullest particulars will be found in the "Revue de l'Architecture," by C. Daly.

As examples of the compensations paid, the following instances may be given :—

	Price offered. Francs.	Price asked. Francs.	Price taken. Francs.
12, Rue du Louvre, and 1, Rue des Fossés St. Germain l'Auxerrois	444,500	611,000	500,000
Place du Louvre, No. 20, and Rue Jean Tisson, No. 9	226,000	312,000	260,000
Rue des Prètres St. Germain l'Auxerrois	192,000	346,444	250,000
Place du Louvre, No. 18, and Rue Jean Tisson, 5 and 7	136,000	224,063	155,000
Place du Louvre, No. 16	110,000	184,514	120,000
Rue des Fossés St. Germain, No. 4	47,000	80,000	60,000
8, Place du Louvre	25,000	75,000	40,000
Same house, a librarian	15,000	33,000	20,000
12, Place du Louvre	14,000	33,000	20,000
Ditto, a wine merchant	15,000	20,000	20,000
14, Rue des Prètres, a notary	8,000	25,000	16,000

As to the selling value of the land, I can offer you the following illustrations :—On the 26th of February, 1856, the City submitted twenty-eight lots of ground for sale, situated, Place Hôtel de Ville, Avenue Victoria, Rue de la Coutellerie, Rue de la Tacherie, Quai Pelletier, and Rue St. Martin. Of these eight lots only one was sold, that of Rue de le Tacherie, containing 166 metres, which, put up at the rate of 300 francs, sold at an increase of 100 francs. On the 7th of August, 1855, the same lots were put up at prices varying from 450 to 500 francs the metre. Four houses put up at the reserved price of 95,000 francs, sold for 152,000; three others, put up at 90,000 francs, sold for 151,400 francs. Land in the old Park at Neuilly sold at prices ranging from 20 to 28 francs the metre. For the land on the Boulevard des Capucines, one lot of 762 metres sold for 456,000 francs: the sixth lot sold for 263,000 francs, and another lot sold for 272,000 francs; but of the last two I cannot give the superficial area. Several lots of ground on the line of road from the Champs Elysées to the Pont de Neuilly sold for 20, 25, and 28 francs the metre.

The formation of the Rue Rambuteau cost	5,259,793	francs
Deduct for re-sale of land	903,863	„
	4,355,930	„

This street is 13 metres wide and 818 long, making the cost for each superficial metre 530 francs.

The Rue de la Banque, 23 m. 50 c. wide, length 228 m., cost 930,882 francs, equal to 312 francs the metre. The Rue Constantine, 13 m. 50 c. wide, length 257 m., cost 1,329,946 francs. The land for the extension of the Rue de Rivoli, estimated to cost 770 francs the square metre, actually cost 818 francs :—6, Rue Montmartre, 74 m., price 85,000 francs, per metre 1,148 francs; 10, same street, 118 m., price 105,000 francs, per metre 890 francs; Rue de Joinville, 1 m. 20 c., price 240 francs, price per metre 200 francs; Rue de l'Orillon, 7 m. 58 c., price 113 f. 70c., per metre 15 francs. Rue du Temple :—Rue Saint Pierre Popincourt, 1 m. 15 c., price 74 f. 75 c., per metre 65 francs; Rue des Chantres, 1m. 04 c., price 26 francs, per metre 25 francs; Rue de Jena, 4 m. 08 c., price 163 f. 30 c., per metre 40 francs.

The demolitions carried out in Paris, by the Prefecture of the Seine, have been, according to the "Moniteur,"*—

In 1852	... 250 houses	... Compensation paid	27,319,210	francs
1853	... 515 ditto	... ditto	24,756,121	„
1854	... 299 ditto	... ditto	19,709,768	„
1855	... 320 ditto	... ditto	29,963,320	„
1856	... 181 ditto	... ditto	24,463,040	„
			126,211,559	„

The value of new buildings and enlargements was as follows:—

		Letting Value.		Selling Value.	
1852	638	1,400,000	francs	28,000,000	francs
1853	1095	4,700,000	„	94,000,000	„
1854	1205	7,000,000	„	140,000,000	„
1855	1614	10,000,000	„	200,000,000	„
1856	2000	12,500,000	„	250,000,000	„
	6552	35,000,000	„	712,000,000	„

Shewing that the value of the buildings erected in 1850 amounted to 22,000,000 francs; in 1851 to 26,000,000; in 1852 to 28,000,000 francs; and eventually in 1856 reached the enormous amount of 250,000,000 francs (£10,000,000.)

I have heard it said that in Paris the municipality has accomplished these works of street improvement with profit; and so in one sense, at least in one case they have. I particularly allude to the case of the Rue de Rivoli. But here it must be observed, that when the Imperial government, having decided on the work, applied to the municipality for its co-operation, it agreed to pay one-half of the sum necessary to form the street running along the Tuileries and Louvre, and one-third the expense of the remainder of the street. When the municipality commenced the work they had contracted a loan of 50 millions, which sum was at a premium, and actually realised 62 millions.

They had then to begin with this borrowed fund of	62,000,000
A fund in reserve of	50,000,000
And a part paid by government of	50,000,000
	162,000,000=£6,480,000.

With this sum in hand, the re-sale of the land and the value of the old materials, it is not marvellous that there was no loss to the municipality. This you will, however, perceive is a case where the government contributed largely to the work, and is no proof that the improvements are self-paying. They are, on the other hand, I believe, quite as costly in Paris as they are in London. The length of this paper prevents me at present noting the subject of the statistics of the town, its population. area, the number of building operatives employed, and the estimated product of their labour, with some other points which appear to me interesting to us as architects. I might also have alluded more particularly to the careful restorations which have been going on in the very interesting mediæval buildings, of which there are many examples in Paris.

The works in the city of Paris are paid for chiefly by duties levied within the town, or by proceeds of institutions belonging to the city, such as cemeteries, markets, abattoirs, water supply, &c. In 1855 the budget provided for the expences of grands travaux for the town, including

* Moniteur des Architectes.

works of architecture, ponts et chaussées, travaux hydrauliques, la grande voirie, the sum of 7,810,000 fr., amongst which were the following items:

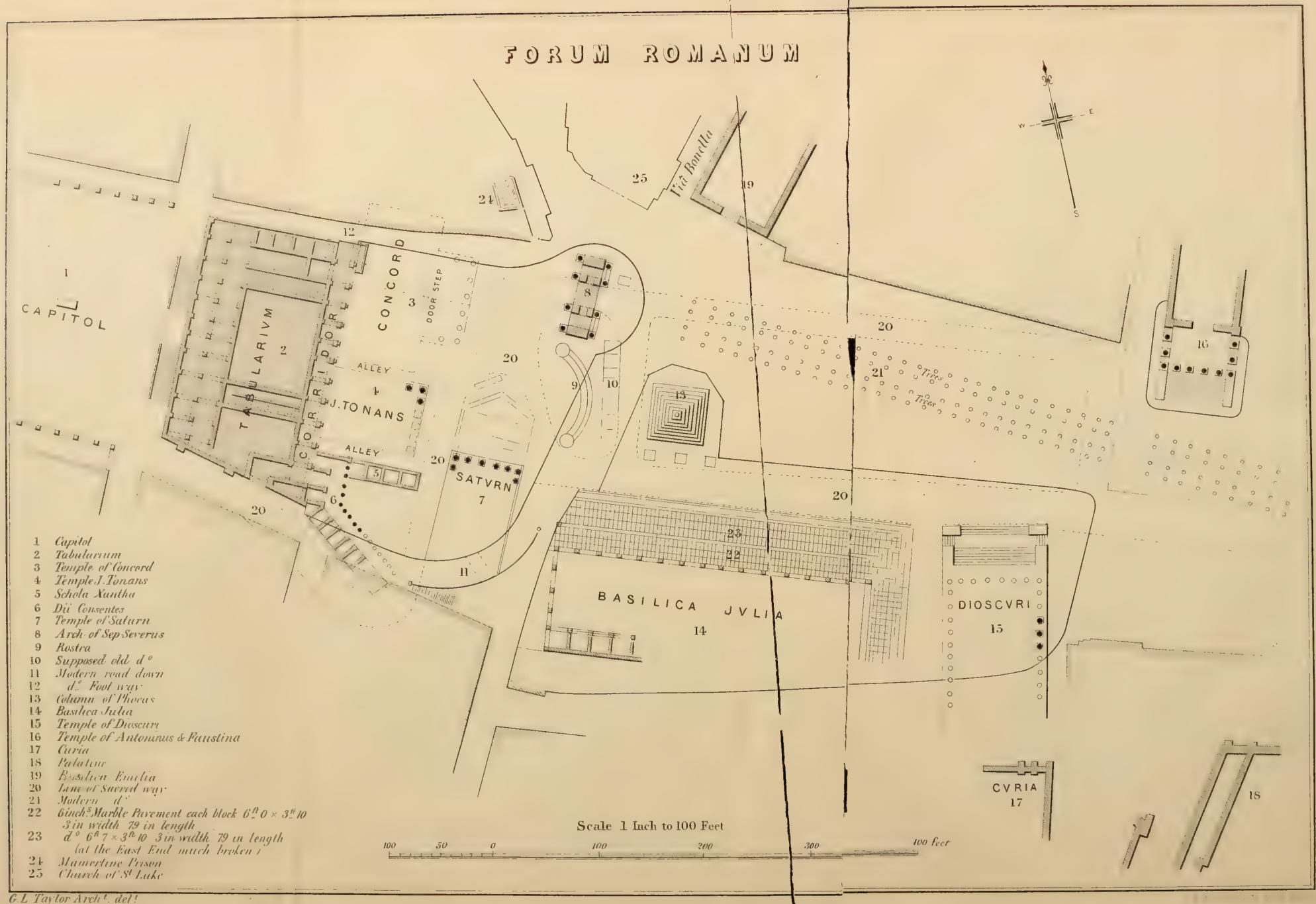
Expenses of Agency	120,000
Sainte Clotilde	400,000
Different Religious Buildings	400,000
School Establishments	300,000
Institut de l'Impératrice	300,000
Cemeteries	100,000
Barrières, Entrepôts, and Abattoirs	100,000
New Prefecture of Police	500,000
Caserne des Petits Pères	300,000
	2,520,000 fr.

The actual total of work was nine millions of francs. In this are not included the works of Notre Dame and the Sainte Chapelle, the continuation of the Boulevard de Sevastopol, nor the paving undertaken at the joint charge of the town and the state. The receipts of the city of Paris for the year ending the 31st March, 1856, amounted to 89,579,287 fr., besides 25,808,454 fr. raised by loan for public works. The expenditure was 63,385,214 fr., of which new buildings and the repairs of old cost 17,421,477 fr. The receipts for the year 1856 are stated to be 50,311,001 fr. Amongst the items of expenditure are:—

Interest of Debt	12,156,493
Expenses of Collection, Salaries, &c	3,705,700
Primary Instruction	1,557,764
Public Worship	98,789
National Guard and Military Service	717,320
Repairs of Public Buildings	4,244,372
Hospices and Charitable Establishments	6,478,651
Libraries, Promenades, and Works of Art	297,454
Public Festivals	902,829
Expenses of Prefecture of Police	9,624,323
New Public Works	13,177,105 fr.

I have this evening purposely avoided drawing any comparison between our own proceedings in this metropolis and those in Paris. We have not certainly amongst us for the last two centuries seen anything like the same display of civic splendour as our neighbours in Paris—neither our tastes nor our institutions tend to it. And it is not only in Paris, but in the provincial towns of France, that the same spirit of improvement prevails; nevertheless, we are also certainly on the move; and although we have not yet arrived at the time when great schemes for the improvement of our crowded city are to be carried out as they have been in Paris, still I cannot but think that we are beginning to be aware of the real necessity which exists for making our London of the nineteenth century as convenient as it is rich and populous—and that when those most pressing works of sanitary improvement —the construction of the great sewers shall have been carried out—when London shall be really one great municipality, and some national plan devised of creating that reasonable amount of revenue which may be sufficient for the purpose—that then our Chairman of the Metropolitan Board of Works may, like the Prefect of the Seine, with the help of a willing government, carry out in London works worthy of the greatness of the city and the empire.

A vote of thanks having been passed to Mr. I'Anson, the discussion on his Paper was adjourned to a future evening.



1 *Capitol*
2 *Tabularium*
3 *Temple of Concord*
4 *Temple J. Tonans*
5 *Schola Xantha*
6 *Dii Consentes*
7 *Temple of Saturn*
8 *Arch of Sep: Severus*
9 *Rostra*
10 *Supposed old d°*
11 *Modern road down*
12 *d°. Foot way*
13 *Column of Phocas*
14 *Basilica Julia*
15 *Temple of Dioscuri*
16 *Temple of Antoninus & Faustina*
17 *Curia*
18 *Palatine*
19 *Basilica Emilia*
20 *Line of Sacred way*
21 *Modern d°*
22 *6 inch Marble Pavement each block 6ft 0 × 3ft 10 3 in width 79 in length*
23 *d° 6ft 7 × 3ft 10 3 in width 79 in length (at the East End much broken)*
24 *Mamertine Prison*
25 *Church of St Luke*

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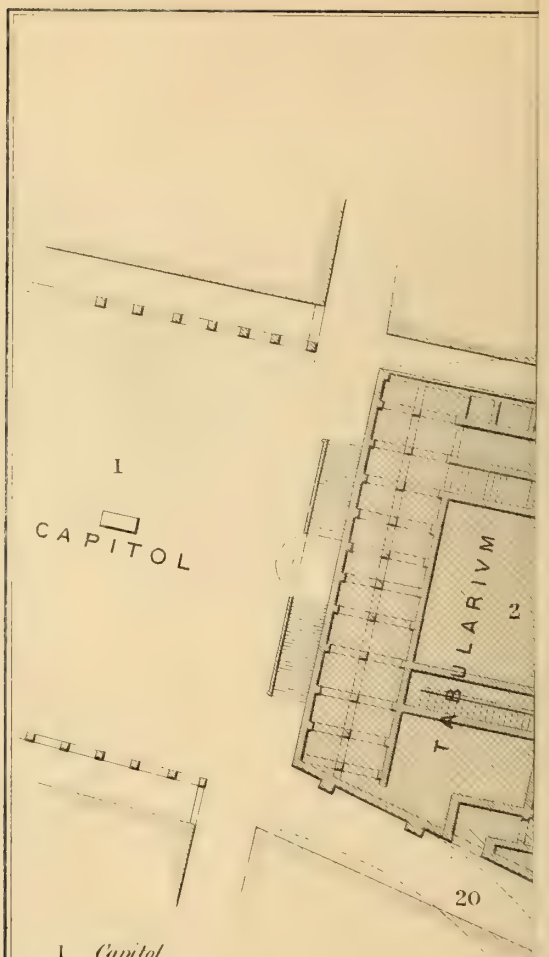

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17 *Curia*
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G. L. Taylor Arch.t del.t

ON ANCIENT ROMAN AND ETRUSCAN ARCHITECTURE AND REMAINS, THE RESULT OF RECENT STUDIES MADE ON THE SPOT.

By G. L. Taylor, Esq. Architect. Read at the Royal Institute of British Architects, Jan. 24th, 1859.

I have willingly accepted the invitation to give you some of the results of my second visit to Rome, after an interval of nearly forty years, in the hope that I may be able to bring forward much fresh matter of interest, even to those who have already visited the Eternal City; as well as to explain the antiquities to those who have not had that advantage. In the period between my two visits the monuments which I saw, and drew, and published, have deteriorated much; but, on the other hand, a good deal has been done in the way of excavating and bringing to light other objects, not only interesting in themselves, but also assisting to identify the sites and remains of buildings, hitherto erroneously denominated.

The history of Rome and her monuments is unquestionably a noble theme. I do not, however, propose to enter on the subject further than is necessary in examining into the construction and probable periods of her ancient buildings. In these Rome stands pre-eminent among the cities of the earth; and the monuments of her fallen greatness, as well as the splendour of her Rénaissance, will attract attention as long as one stone stands upon another. At present our concern is with Ancient Rome. I will first explain the drawings I have brought to illustrate my subject. The large drawing is a representation of perhaps the most interesting part of ancient Rome, from the Tabularium in the Capitol, over the whole area, where once was the Roman Forum; the view extending to the Coliseum in the distance, to the Arch of Titus, and to the Palatine Hill. This drawing is 10 ft. by 4 ft. 6, and the extent comprises 180 degrees of the horizon, which, consequently, cannot be embraced without turning the body; it should therefore be viewed at a distance of about 8 or 10 ft., the eye being level with the horizon. In the centre of the picture we are looking North, to the left nearly due West, and to the right East. We are standing above the Clivus Capitolinus, on the modern carriage-way leading from the Capitol down to the Via Bonella, where the road is about 30 ft. above the level of the ancient pavement at the Arch of Septimius Severus. Beginning from the left, we see the Modern Capitol angularly. In the centre of the square is the equestrian statue of Marcus Aurelius, and on the North and South sides the galleries of sculpture and painting, buildings of Michael Angelo. Then comes the South flank of the Tabularium, where we see much of the ancient Etruscan walling of that building, now the offices of the modern S. P. Q. R. Next, the Eastern façade of the Tabularium, with its magnificent basement wall, formerly, and still nearly 300 ft. in length, and 26 courses, or 50 ft. in height; each course precisely 1 ft. 11 in height (two ancient Roman feet, or one modern Florentine braccio). This wall is 11 ft. 8 in thickness, with piers equal in width to the openings; and I found on careful examination that every stone in this vast building was a double cube of 1 ft. 11, that is, 3 ft. 10 long, 1 ft. 11 high, and 1 ft. 11 wide, all precisely of one size, laid "header and stretcher," and put together without any mortar or cement, with the finest joints, and the perpendiculars truly kept in them. On this subject I have much to say hereafter. Above this basement was an arcade with fifteen openings, the piers having half columns in front, of the Doric order, with Greek Doric capitals and architrave. Several of these arched openings are clearly traceable, and in one, the ancient masonry is exposed, but it was not considered safe to clear more with the high modern wall bearing upon them. Behind the front wall is a corridor, 15 ft. wide, the whole length, arched. On the North

side of the Tabularium is seen the modern footway from the Capitol down to the church of S. Guiseppe de Falegnami, under which is the Mamertine prison. Above this view is the geometrical plan of the buildings from the Capitol to the Coliseum, to a scale of 1 in. to 10 ft. from measurement on the spot. This plan is 26 ft. in length, and represents an extent of half-a-mile. By it the various buildings seen in the view may be traced and referred to as we proceed, each building being delineated accurately to that scale. Continuing the view, we pass the remains of the Temple of Jupiter Tonans, then the Arch of Septimius Severus; between which is the Church of St. Luke. In the foreground is the Temple of Saturn (generally called of Concord); behind the Arch is the part of the Church of S. Adriano, the remains, it is supposed, of the Forum of Paulus Emilius. Between the two last columns of the Temple of Saturn is seen the Column of Phocas. Behind the Temple of Antoninus and Faustina appears the top of the Basilica of Constantine, generally called the Temple of Peace. In the distance is the Coliseum; in front of which is the Church of S. Francesca Romana. The line of the present Sacred Way is shown by trees recently planted from the Arch of Septimius Severus; at that end, on a level of 30 ft. above that of the ancient road up to the Arch of Titus, where the pavement remains in its original level and state: more of this ancient pavement is seen in front of S. Francesca Romana. In this line occurs the Church of SS. Cosmo e Damiano, where the marble pavement or plan of various buildings of Rome was discovered. The Palatine is seen on the high ground to the right, covered with trees. Below the Arch of Titus are the three beautiful columns of what used to be called the Temple of Jupiter Stator, but now supposed to be that of the Dioscuri, Castor and Pollux. Twenty names have been given to this temple, but I consider the Dioscuri entitled to the claim. Behind these columns is the Church of S. Maria Liberatrice, and to the right of that, the large brick building supposed to be the remains of the Curia Hostilia. Between the Temple of the Dioscuri (which is restored on the plan to its whole extent) and the Temple of Saturn, nearly the whole area is filled up by the pavement of an extensive building, lately discovered, which is supposed to be that of the Basilica Julia, built by Augustus and dedicated to his daughter.

By reference to the plan it will be seen, that from the carriage pavement of the Sacred Way there are for a considerable length, first, two steps and a landing of 4 ft. 4, then three other steps, then a landing of 3 ft., then a range of 6 in. marble pavement of blocks, 6 ft. 7 by 3 ft. 10, three in the width, then other two steps. Then another range of three 6 in. blocks, 6 ft. by 3 ft. 10 each; these six ranges of large blocks remain in place, 79 in number and 6 in width, in the whole length from East to West, filling up nearly the whole extent, viz. 300 ft. Then comes a range 2 ft. 10 wide, which appears to mark the line of the wall, or piers of the building, to the North; of which piers there appear to have been sixteen, 20 ft. from centre to centre. Then comes a thinner pavement, $1\frac{1}{2}$ in. thick, probably over the covered part of the building. It is too much destroyed to make out the pattern. In the will or record left by Augustus (called the Monumentum Ancyranum, wherein he boasts of having found Rome brick, and left it marble), this Basilica is mentioned as adjoining the Forum, and extending from the Temple of the Dioscuri to that of Saturn. He states that he is constructing it, and leaves directions to his heirs to finish it, in case of his death before its completion. This would appear decisive, both of the certainty of its being the Basilica Julia, and also of the nomenclature of the Temple of the Dioscuri (formerly called Stator), and of Saturn (formerly called Concord). How *the* three columns could ever have been supposed to be the remains of the Temple of Jupiter Stator, built and dedicated by Romulus, is unaccountable. At the West end are five brick piers, with stone springers, and the commencement of arches. This building was repaired by Domitian; and these would appear to be his work, from the nature of the brick (or tile) work. All this is shown on the large plan, every

stone being marked with its dimensions. The modern road hides much of the recent excavations. I have therefore adopted a slide over the lower part of the drawing, by lowering which are exposed the Temples of the twelve Dii Consentes, and the columns in front of them, of light-coloured marble. They are placed angularly, partly under, and wholly hidden by the modern road. These columns are all about 18 ft. high, and 1 ft. 10 diameter; the capitals formed of arms and shields, the shafts fluted, with astragals between the flutes, rounded at the top and bottom, and finished with a tongue between each, as in the interior columns of the Pantheon. In front of these temples was discovered a marble pavement, or area, *under* which were the offices of the notaries or barristers, called the Schola Xantha, from the curators, Bebrix Drusianus and A. Fabius Xanthus, who adorned them with marble, and erected silver statues to the gods. The marble sills of these cells or offices remain, and there was an alley to the North, the pavement of which remains; and there was another range of offices on the North side of it. Here, sat the lawyers to explain the laws to enquirers: at the end of the alley was an archway in the Tabularium wall, leading to a staircase, by which they ascended to the upper part of the building where the tables were deposited for reference. In the fire of Vitellius 30,000 of these tables of bronze were destroyed. The nature of them is known from some found and preserved at Gubbio. This archway was filled up with masonry, and the Northern range of the Schola Xantha removed by Vespasian; who being miraculously preserved from a thunderbolt, which killed his armour-bearer, resolved to dedicate a temple to Jupiter Tonans, and to obtain a site on this most sacred Clivus, built up the archway, and removed the Northern range of offices. This archway is now exposed to view, though still walled up; and after having much difficulty in obtaining permission from the senator, Prince Orsini, to plant a ladder, I followed the steps of this ancient staircase from an upper corridor (the steps up to which were also found, and are shown on the plan) down to the inside of this archway. In an angle of this staircase, when first discovered, were found office pens, or stili of the day, which are preserved in the Museo. This temple was in front hexastyle, the columns 47 ft. high, 4 ft. 10 diameter. The nature of the returns is only supposed. The steps of approach must have been difficult of arrangement, from the small space between it and the sacred Clivus. That this is the temple so dedicated to Jupiter Tonans there appears no doubt, however uncertain the identity of some of the others may be. To the North of this temple are the substruction and pavement of the Temple of Concord, also lately exposed. This temple, erected originally by Camillus, was restored by Tiberius. It appears to have been 150 ft. in extent from South to North, and the cell 60 ft. wide from East to West. In this great hall the senate was wont to hold its permanent sittings and councils on urgent affairs. It seems to have had a portico advancing in the centre, before the cell; and here Cicero addressed his celebrated orations to the assembled Fathers, when he saved the state from the dangers threatened by the Cataline conspiracy. The foundation for the steps in front remains, reaching to within 35 ft. of the Arch of Septimius Severus, and the door-step of the temple is still in its place, being composed of two pieces of "Pavonazzetto" marble, each 25 ft. in length, 4 ft. wide, and, 2 ft. thick. In the centre appear the pivots for the doors, with a sinking in the marble for a caduceus. The cell of this temple is peculiarly appropriate for public meetings, and the form of its façade is corroborated by medals. The whole area was paved with thin marble, the bedding of which, and some of the paving still appear, also some of the masonry of the high altar, and the marble lining of some of the walls, to the height of 6 or 8 ft. The same appearances are left in Jupiter Tonans. The substructions warrant the tracing of the front portico as hexastyle and systyle, as shown on the plan, and the columns must have been nearly, or above, 6 ft. in diameter, and 60 ft. high. It does not appear that, at the time of the excavation, any of the columns or capitals were found, but enough of the entablature was collected to enable Canina to set up, partly original, partly restored, a

length of the whole entablature, which is represented on these drawings to the full size. The height of the architrave is 3 ft. $8\frac{1}{2}$, the frieze the same, and the cornice 6 ft. $4\frac{1}{2}$, total 13 ft. $9\frac{1}{2}$. He has also set up a length of the entablature of Jupiter Tonans in the same corridor. This cornice is very finely designed and executed, and its analogy with that of the so called "Jupiter Stator" is very striking. Concord has the advantage in size over Stator, but both bear the style of the Augustan period. As I before observed it was restored by Tiberius Cæsar. I also exhibit the entablatures of Concord and Stator, each a quarter the real size, for comparison.

We now work our way to the Arch of Septimius Severus, which is too well known to require much explanation. I found, however, at my recent visit that there are steps to the side arches. The Basalt, or lastricated pavement of the carriage way through the centre and all up the Clivus, rising rapidly, and proceeding tortuously between the Temple of Saturn and that of Jupiter Tonans, is all exposed; it may be traced also at the entrance of the Tabularium, and its course conjectured round the Dii Consentes, up to the Capitol. I have shown this on the large plan, and traced the probable course of the Via Sacra from the Meta Sudans, showing its supposed turn (and division into two), round the precinct wall of the Temple of Antoninus and Faustina, shown by Palladio, though I am by no means convinced that he ever saw such a precinct wall. Our early architectural restorers appear to have indulged a little in fancy, and we are in some instances misled thereby.

The other view is taken from a point near the Arch of Septimius Severus, looking across the Clivus Capitolinus to the Tabularium. To the left is the Arch of Septimius Severus, seen angularly; fronting you is the Temple of Saturn (formerly Concord). The steep ascent of the Clivus is well seen, the basement wall of Saturn being 15 feet high to the right, and double that height to the left. This base wall is of stones once appertaining to early construction, being pseudisodomum, or unequal in height. The modern carriage road leading to the Capitol, and its arches, are seen, and under them the columns in front of the Dii Consentes; and under them again the low level arches of brick of the Schola Xantha; the Tabularium Arcade, with its fine Isodomum basement wall underneath, also the three columns of Jupiter Tonans, and the foundation of the Temple of Concord; the modern building over the ancient arcade, and the tower of the modern Campidoglio.

I will now direct your attention to the large plan from the Capitol to the Coliseum, both inclusive, made from measurement, and to a scale of 1 in. to 10 ft. The extent comprised in this drawing (which is 26 feet in length) is 3,133 feet, or above half a mile. First comes the square of the modern Capitol, with Michael Angelo's buildings on three of its sides. Then the plan of the area of the Tabularium is given, with the site of the staircase from the long corridor or arcade, up to an upper corridor, from which I descended by the other staircase to the back of the archway from the Schola Xantha. Every ancient stone of this immense building is a double cube of two ancient Roman feet, *i.e.*, 3 ft. 10 × 1 ft. 11 × 1 ft. 11 of our scale. The carriage road to the South, and the footway on the North, down to the Forum, are shown; the site of the Temple of Concord, and the probable extent of its portico; Jupiter Tonans, the Dii Consentes, Schola Xantha, Temple of Saturn, and the Clivus winding between them to the Arch of Septimius Severus, and apparently also turning towards the Basilica Julia; the Column of Phocas and three pedestals; then the Rostra: the one to the West, circular in form, with a round pedestal at its North end, is found to be faced with thin marble of various colours in panels and pilasters. In front of these Rostra are the large and ancient tufo construction of walls, of which it is difficult to assign the use or purpose. By some they are supposed to be the earlier Rostra. On the North side of the Arch of Constantine is a bas-relief representing the Emperor holding his Court on these Rostra, and the representation of the scene and of the site is ingeniously traced to this spot by Canina.

The position of the Basilica Julia is shown, and of every block of the marble pavement in front of it, from which every one may make his own deductions; they definitively settle the extent of the Roman Forum in that direction, *i.e.* to the South. The position of the temples of Antoninus and Faustina, of Remus, of the Basilica of Constantine, of Adrian's temples of Venus and Rome, of the Arch of Titus, the Coliseum, the pedestal of Nero's statue, the Meta Sudans, and the probable course of the Via Sacra, of which the pavement is found in several places, are also all represented.

These antiquities are described by numerous authors, of whom I have not less than 194 names in my list. Among the early historians, are Herodotus, Plato, Cicero, Varro, Horace, Pliny, Livy, Strabo, Vitruvius, cum multis aliis, and subsequently Sextus Rufus, Publius Victor, the Capitoline Base, the "Notitia," the "Mirabilia." These writers led the way and afforded arguments for a host of successors, of whom among architects are Alberti, Bramante, Baldassar Peruzzi, Sangallo, Labacco, Serlio, Scamozzi, Vignola, Palladio, Pirro Ligorio, Milizia, Vasari, Desgodetz, Fontana, Cameron, Du Perac. Then follow in my list 131 others, of which I will only mention Winkelmann, Agincourt, Cicognara, Piranesi, Guattani, Gell and Nibby, Pinelli, Bunsen, Müller, Niebuhr, Plâtner, Braun, Hobhouse, Burgess, Valadier, Taylor and Cresy, Murray's Handbook, for the general accuracy of which I can vouch, Smith's Dictionary of Greek and Roman Geography, the article Rome, in which the classical references to the subject, and the German and Italian controversies, are ably given; and though last, not least, Canina, who has fully gone into the whole subject. His works, however, are too extensive and too expensive for general possession, and difficult of reference; they require to be condensed, and the dimensions more clearly and accurately expressed.

I will now proceed to treat upon the interesting architectural relics, more upon their *own* testimony than that of verbose writers. "Parlano anche i Sassi." Even stones will speak! and sometimes more truthfully than writers. Commencing historically, we will take the known works during the period of the seven kings, *i.e.*, from the foundation of Rome by Romulus, 753 years B.C., to Tarquinius Superbus, who was expelled in the 245th year of Rome. The length of the reigns of these seven kings is worthy of observation. 1. Romulus, 753 B.C., reigned 38 years. 2. Numa Pompilius, reigned 43 years; he came from Cures, the capital of the Sabines. 3. Tullus Hostilius, reigned 32 years; in his time the war with the Albans and the conflict of the Horatii and Curiatii occurred. 4. Ancus Martius, reigned 24 years; he enclosed the Aventine and Janiculum Hills, founded Ostia, built the Mamertine Prison, and the Sublician Bridge. 5. Tarquinius Priscus, reigned 39 years; he quitted the City of the Tarquins to come to Rome, built the Cloaca Maxima and the Pulcrum Littus. 6. Servius Tullius, reigned 44 years; he enclosed the Seven Hills with walls, a great part of which remain to this day, much having lately been discovered. 7. Tarquinius Superbus, reigned 24 years. His brutal rape of Lucretia eventually caused his expulsion from Rome; he fled to Tarquinii and claimed his Etruscan consanguinity. Porsenna, king of Clusium, marched to Rome with a large army in order to restore him, encamped on the Janiculum, and would have crossed the Tibur but for the heroic defence at the bridge by Horatius Cocles, who stayed the enemy while the bridge was destroyed behind him. Of these works there still remain—of Ancus Martius—the Mamertine Prison, upper and lower; of Tarquinius Priscus—the Cloaca Maxima, and the Pulcrum Littus, or beautiful shore; of Servius Tullius—the walls surrounding the City and enclosing the Seven Hills. All these are of the time of the kings and their dates are known; the stones speak for themselves; they are of tufo and all of the same dimensions, viz., the double cube of 2 ancient Roman feet—3 ft. 10 × 1 ft. 11 × 1 ft. 11, English,—the joints worked with the greatest precision, and without cement. During the Republic, the Romans were engaged in 21 serious wars, and we can trace but little the dates of their works of construction; however the Tabularium is a fine exception, the date of which we know by an inscription

still visible, stating that it was constructed by Q. Lutatius Catulus, in the year of Rome 651, or 102 B.C. It is still "to the fore" nearly 300 ft. in length, and 50 ft. in height; the stone is Peperino or tufo; the courses Isodomum or equal, header and stretcher; every stone a double cube of 2 ancient Roman feet. Of the works of which we know not the date, but which declare themselves to be as early, the finest specimen is the Peribolus wall of the Temple of Mars Ultor. The temple itself was, it is believed, built by Augustus, but I imagine the surrounding wall is far anterior. About 500 ft. in length of it remain, and to a height of 100 ft. It is Isodomum, or of equal courses; precisely 1 ft. 11, or 2 ancient Roman feet in height; laid in alternate courses, header and stretcher, but the stretcher courses are 3 cubes, or 5 ft. 9 in length. The cornice also is bold, and the skew arch (arco dei Pantani) is a magnificent piece of masonry. There is also some masonry of tufo lately discovered at the foot of the Palatine Hill on the West side. These stones are double cubes of 2 Roman feet, jointed like those of the Tabularium, and bonded into the solid tufo of the hill, which is of the same material. These must be very ancient. I should observe that all the Seven Hills of Rome are composed of a mass of volcanic tufo, and that most of them have alleys cut through them in various directions. Following up my hypothesis of judging of the dates of Roman buildings by their masonry, I must quote for the size of their stones, though not for such regularity:—the Tomb of Scipio, 456 A.U.C.; the Tomb of Cecilia Metella, (Capo di Bove,) B.C. 67; one of the finest specimens of early construction, the circular surface being composed of the finest Travertine; the Island of Esculapius in the Tibur, constructed in the form of a vessel; the Theatre of Marcellus; the Coliseum; and the Temple of Fortuna Virilis. The Travertine stones of the cell of this temple are exactly to the guage of the 2 Roman feet, or 1 ft. 11 English,— a strong argument in favour of its reputed erection in the time of Servius Tullius, and its restoration in the time of the Republic.

We will now trace whence the Romans derived this magnificent construction. For this end I must introduce you to Etruria, of which I made the tour in search of "old stones." The origin of the Etruscans is—like that of the Romans—legendary; it is hardly known whence this enlightened race came. Their Lydian origin seems most probable; their entry into Italy is placed by some before the Trojan war, but the subjects on their most beautiful vases, representing the heroes of that time and their mighty deeds, with the names, Ajax, Achilles, &c., written in Greek at the side, would seem to controvert this idea. We may probably place it three or four centuries before Romulus. Rome, before her intercourse with Greece, was indebted to Etruria for her chief lessons in art and science. The history of Etruria, as there are no chronicles extant, and her race and language have been swept from the earth, must be gathered from the mighty walls and gates of her cities, of massive stones, put together with the finest joints, and without cement; from her tombs and their contents, which remain to this day. "Parlan le tombe e murà, ove la storia è muta." Tombs and Walls speak, where history is mute; as we shall see. But first regarding the language: although we have as yet been unable to decypher what is left of it, many attempts have been made to obtain the key, and at this time a member of the Collegio Romano, by name Tarquinio, and probably, therefore, a descendant of the Etruscan Tarquins, has propounded the idea that it is derived from the Hebrew, and has given, in the "Civiltà Cattolica," (an authorized publication of the church,) translations, word for word, of several inscriptions, and is proceeding with others. The character is very peculiar, and, like the Hebrew, read from right to left. We may therefore be able to enter more fully into the history of Etruria. Of the twelve confederate cities, nearly all were at different times struggling with the superior power of Rome, which eventually subjugated all those in which the walls are found agreeing precisely in size and construction with the walls in Rome already described; of which they were evidently the forerunners.

At *Sutri*, much walling remains of the precise size of the stones of the Tabularium, "Isodomum;" much also "Pseudisodomum." Here is also an Etruscan amphitheatre, the seats and arena cut out of the solid tufo rock; the podium, an arched communication under it, the seats, &c., mostly remaining. This amphitheatre is supposed to have given the idea to the Romans. Here are also many tombs, and a mediæval church, cut out of the solid tufo. At *Nepi*, is much of the regular Isodomum walling, precisely the same in size and construction as in the Tabularium. At *Faleri*, near Civita Castellana, the whole of the walls of the city known to have been built B.C. 241, remain, though not only the buildings of the ancient city within them are gone, but also of a mediæval city the ruins only of a church remain. These walls enclosed a city three miles long and two broad, and they remain round the whole circuit; two gateways also remain, with noble semicircular arches. The walls are Isodomum, the courses each 1 ft. 11 high throughout, but the stretchers are larger, and the perpendiculars of the joints are not preserved. These walls in some parts are 26 courses, or 50 feet in height; they are 7 ft. 8 in. thick, or two stones of a double cube. At *Fiesole* are extensive Etruscan walls, but more irregular in their construction. At *Cortona* the walls are Pelasgic, of large blocks; and there is a Tomb with a semicircular arch of fine masonry. At *Siena* there are remains of the ancient city walls, "Pseudisodomum." At *Volterra*, the stones are larger, and may be called Cyclopean; the gateway bears a bold Etruscan character, with three ominous-looking projecting heads. At *Clusium*, the ancient stones of the walls lie scattered in more modern buildings. At *Perugia*, much of the Etruscan walling of the ancient city remains, with more extensive walls of *Braccio Forte Braccio*, of the 15th century. In the former still remains the magnificent North entrance gate, the most imposing gateway extant. Perugia was besieged 40 years B.C. by Octavius Cæsar, and set on fire by the inhabitants. I have represented this scene in a "tempera" drawing, and the gateway as it now appears in another. Perugia has maintained its high position in every phase of her existence, and at this time rises superior to every other Etruscan city in her state of modern art and civilization. Near it is the tomb of the Volumni, an Etruscan family, the monuments of whose members are still preserved in the vault, which is cut out of solid tufo, the ceiling and walls ornamented by sculpture in relief, the last member being a Roman who married into the family. At *San Manno* there is also an Etruscan, semi-circular arched tomb of fine masonry, and an Etruscan inscription. At *Albano*, the ancient Alba Longa, are great remains of "Pseudisodomum," and the masonry of the *Emissario* is Etruscan in character, and grand in size. I could name many others if time permitted. The ancient usages of the primitive Etruscans appear to have been preserved and followed by the moderns more in Florence and Siena than any other part of Etruria. The Florentine Braccio, which is the measure of their early masonry, is exactly 2 ancient Roman feet (1 ft. 11 of ours), while the Braccio of every other Italian state or city is different. It would appear, therefore, that there was some law or reason for the measure, which was so respected by the Romans. The Florentines continued in the Rénaissance to adopt the grand and imposing style of building of their ancestors—Michelozzi, Maiano, Brunelleschi, Michel Angelo, Pollajolo, Florentine architects who studied in Rome,—followed up this peculiar style when they returned to their native city to practice as architects. The Strozzi Palace, commenced by Maiano, 1489, continued by Pollajolo; the Palazzo Pitti, by Brunelleschi, 1435, finished by Ammanati, 1559; the Palazzo Riccardi, by Michelozzi, 1430; are all in the bold, massive, rough, though grand and regular style. The height of the Braccio is not preserved in the courses, but the massiveness, which appears to us heaviness, is, with great regularity and closeness of joints. In the Façade of the Palazzo Pitti, I have traced stones 25 ft. long, 2 ft. 2 high, and probably 2 to 3 ft. on the bed. The Palazzo Vecchio, of earlier date, is in the same style, but the stones are smaller. Among the moderns this style is quite peculiar to Florence and to Siena. We have thus traced their similarity of construction

in the early buildings in Rome to those remaining of ancient Etruria: many other most interesting relics are found in Etruria which bear on the subject, and prove their superior state of civilization. We have now to trace on to Augustus, who became Emperor in the year 30 B. C., and died in the 14th year of the Christian Era. He boasted to have found Rome *brick* and to have left it *marble;* and we shall find few, if any, *marble* buildings before his time. We know from Strabo, who wrote in the time of Augustus, that the whole of the Campus Martius was covered with fine buildings; and the Mausoleum of Augustus, and the Pantheon, with several other remains, corroborate his statement. The Temple of Concord, and of the Dioscuri, the noble marble construction of which you see in full sized drawings on the walls, prove the state of architectural construction and sculpture in the Augustan period. We know that in the Capitol itself there were still nobler buildings, of which nothing remains. We know that to the Northward of the Capitol was a range of buildings, the Forum of Augustus, of Trajan, of Nerva, of Paulus Emilius; Eastward the Temple of Peace; and of Venus and Rome, the work of Adrian; with numerous other magnificent edifices, raised by the different Emperors down to Constantine, whose Basilicæ, and numerous churches, formed out of ancient buildings, are of much interest; so that the whole area of the city, not only within the walls of Servius Tullius, but extending to those of Aurelian, were covered with them.

I regret that another evening is not at my command to explain the details of such of the *marble* buildings as remain, and to show that, as Etruria was instructor to the Romans in *stone* erections, so Greece was in those of *marble;* the hand of the Greek artist being apparent in every ornament. As I have described the city walls of Servius Tullius to have been found lately in great extent, of the peculiar sized stones and "Isodomum," construction, I have explained, I may briefly mention the nature of the Aurelian walls, which are in their way deserving of notice. They are of brick or tile, and a plan of their disposition is shown. They consist of a thick outer wall, to which are attached buttresses, arched over and perforated with openings through each. There are towers at distances of about 200 ft., with staircases, so that the warders could give notice of an attack; and a regular communication throughout being formed by the openings, the soldiers could flock to any part for defence. These walls remain for a great part of their extent.

Having concluded his observations on the immediate subject before the Meeting, Mr. Taylor proceeded to avail himself of the opportunity, in an assembly of Brother Architects, to pay a tribute to the memory of his old and valued friend, and companion during his previous researches in Rome, Mr. Edward Cresy; entering into interesting details of the professional education and subsequent career of that gentleman at greater length than the limits of this paper permit to be published on the present occasion.

Mr. Taylor's paper was listened to with much attention, and the cordial thanks of the Meeting having been conveyed to him by the Chairman, the Members adjourned.

VARIOUS MATTERS CONNECTED WITH ST. PAUL'S CATHEDRAL.

By F. C. Penrose, Fellow. Read at the Royal Institute of British Architects, Feb. 7, 1859.

This paper will, I fear, be greatly wanting in unity, as I shall have to enter on different subjects while carrying out the purpose I have in view of tracing rapidly the history of our magnificent Cathedral since it passed out of the master hands of Sir Christopher Wren down to the present time; and then of inviting your consideration of some topics which may have influence on its history for the future. In accomplishing my task, I must claim your indulgence if I am obliged to introduce matters in which I have a personal responsibility. All present are, no doubt, familiar with the history of the commencement, and the general progress of the building during the reigns of Charles II, James II, William and Mary, and Anne. The great architect's task, while steering through the difficulties opposed to him, was no easy one: even during Anne's time he was very shamefully treated,* and continually thwarted by the Commissioners appointed to administer the funds, &c.; but after the accession of George I. in 1714, Wren, being then 82 years of age, endured for four years continued annoyances from intriguing persons, favourites of the new dynasty, and was finally dismissed from the Office of Surveyor—still unimpaired in mind and even sufficiently strong in body to superintend the works; and an ignorant person, named Benson, was installed in his place—a man of such incapacity that after one year's trial he was ejected. At this time it would appear that almost the only parts of the external structure not completed were the statues on the pedestals, respecting which Wren wrote, Oct. 28, 1717, "The pedestals for the statues I have already laid in the building which now stand naked for want of their *acroteria*." The balustrade above the general entablature was not, as you are aware, designed by him; and it is probable that it was not executed until after his dismissal. Still it is presumable that when the Commissioners insisted on it he may have made the drawings, though under protest, for fear of his design being still more interfered with, if put into such hands as Benson's. So far as the execution is concerned, these late works were worse done, and have given more trouble to keep in repair than any other parts of the structure.

Wren having replied to the Commissioners Oct. 28, 1717, protesting against the balustrade, was dismissed April 26, 1718, from his office of surveyor. We may just pause to reflect on the misfortune of political intrigue interfering with architectural appointments, and to indulge the wish that instead of Benson being made surveyor, Wren's own pupil, Hawksmoor, had been commissioned to assist him; or Gibbs, who has shown in the tower of St. Clement Danes (added to Sir Christopher's church), that he well knew how to combine his own work with that of his great master. The addition, however, of the balustrade over the main cornice, and the omission of the vases on the piers of the balustrade over the colonnade of the dome, are but slight matters in the general aspect of the Cathedral; and we may indeed be thankful that in its integrity the external design, as executed, displays the intentions of Sir Christopher Wren. The building cost in round numbers £750,000. and the works were in hand during the period of 44 years under his actual superintendence.

A longer period of the great architect's presiding care could hardly have been hoped for; but had the funds exceeded the moderate average of £17,000. a-year, some portions of the work might doubtless have proceeded more rapidly, and his views for the embellishment of the interior might have been carried out more or less perfectly. We are not acquainted in detail with these views, but we know

* In a curious cotemporary pamphlet "Frauds and Abuses in St. Paul's" he, with the master workmen, and others under his charge, was attacked in a most unjust and unscrupulous manner.

that mosaic work and marble decoration entered largely into them, and we cannot doubt that the whole interior would have corresponded in magnificence with the exterior.

It is impossible to say how far Sir James Thornhill acted in concert with Wren, when painting the cupola of the dome. All that can be stated is, that in the year 1711 the latter writes despondingly about it. "As for painting the cupola your lordships (the Archbishop and the Bishop of London) know that it has been long in consideration; that I have no power left me concerning it, and that it is not resolved in what manner to do it or whether at all." This was written in 1711; Sir Christopher Wren being 80 years old. Again, the decoration by Thornhill is quite different from the coffered arrangement of Wren's first model and from that shown in an early print. On the other hand, Thornhill seems to have been on friendly terms with Wren; for he was employed on his works at Greenwich and at his college of All Souls, Oxford.

However, considering the barocco style of Thornhill's decoration, I think Sir Christopher's wishes could hardly have been consulted, and we may be thankful that more, such as is shown in Gwyn's section, was not done; for, however naked the interior may appear at present, it does not shock by reason of any tawdry effect; and should the public subscriptions, now invited for the purpose of carrying out a suitable embellishment in accordance with the views of Sir Christopher Wren, flow in with sufficient spirit, it will be possible to ensure a vastly superior effect, by following such examples as St. Peter's, and Sta. Maria Maggiore, instead of the fashion of the beginning of the eighteenth century.

To proceed with the history of the building. There seems to have been but little done after Sir Christopher left it, till towards the end of the last century, when, under the surveyorship of R. Mylne, apprehension was felt for the safety of the fabric, arising from settlements chiefly apparent in the North and South transepts; and large iron ties were introduced into the walls at the level answering to the triforium of Gothic cathedrals. So far as I can judge, these ties have either arrested the threatened injury, or, the cause of it, viz. the compression of the substratum, having arrived at its maximum, there are no present grounds for apprehension. Should, however, any deep cuttings, *e. g.* for a sewer, be formed in the immediate neighbourhood (one was actually commenced in 1831, which would have passed 20 feet below the level of the foundation, and only 50 feet distant, but was fortunately stopped by Mr. Cockerell's vigilant resistance), there would again be cause for alarm. At present, owing to Wren's admirable precautions and the care taken of the fabric by such surveyors as Mr. Mylne and Mr. Cockerell, (care, it is to be hoped, which will never be wanting when necessary) the fabric is in a remarkably sound condition, and the small amount of displacement of the stones, visible here and there, is no more than is inevitable in so solid and lofty a structure founded on the London clay.

There does not seem to have been anything done towards the embellishment of the interior, except a pulpit by Mr. Mylne, and an alteration in the front of the organ screen (making, perhaps, rather too much of the original modest panel dedicated to Wren's memory, "Lector si monumentum requiris circumspice,"—an inscription which has again given place to an expansion of the organ itself) until the year 1821, when Mr. Cockerell superintended the restoration of the decayed gilding and decorative painting at the East end, and at the same time most effectually renovated the ball and the "cross of gold, that shines over city and river."

During the first twenty years of the present century, however, the walls of the interior have been appropriated to the reception of monuments, good, bad, and indifferent; which, while they certainly add interest to the cathedral, seem even to enhance the cold aspect of its architecture. An opportunity now offers itself, in the Wellington monument, to combine more colour with the composition, which will, I trust, not be altogether thrown away. The paintings of the cupola having become nearly black

and obliterated in many places, have been restored. I had the pleasure of bringing this subject before you in 1852. The zeal of Mr. Parris in undertaking, and his energy, courage, and skill in carrying out this extensive work, are worthy of very great praise. The simple and effective contrivances, his own designs, for supporting himself in his eyrie in the air were well worthy of attention; and the adoption of them will greatly facilitate the execution of whatever may hereafter be done in the way of embellishment to the other vaulted portions of the interior. If, however, the present more ambitious views—perhaps rather dreams—dreams that, nevertheless, I will hope may work in the direction of their own fulfilment—had been entertained at that time, it is probable that Sir James Thornhill's work, which, whatever its merits, must be pronounced only second-rate, would hardly have been followed and restored so scrupulously.

Besides the restoration of the paintings, the only important work executed in or about the Cathedral within the last few years, until the recent opening of the dome area for Divine Service, is the tomb of the Duke of Wellington, and the arrangement of the two adjacent sepulchral chambers containing this and the tomb of Nelson. The tomb of the latter is placed under the centre of the dome, surrounded by eight Doric columns, whose bases were hidden by the floor of the crypt having been raised, for some unknown reason, nearly two feet above its original level. The bases having been found on excavating, the pavement was lowered, and the columns restored to their original appearance. The vaulted covering over this part was found to be pierced by a number of lead pipes in the haunches of the groins; the object of these pipes is evident when we remember that, for many years after the rest of the church was finished, the central portion was open to the sky.

The sarcophagus of the Duke of Wellington is composed of schorl porphyry from Luxulian, near St. Blazey, on the Treffry estate in Cornwall. Previously to the adoption of this, considerable time was occupied in endeavouring to obtain from Ireland a suitable material. The Clenony marble from quarries on the banks of the Shannon, near Banagher, King's County, Ireland, was particularly examined for that purpose. Blocks of sufficient size could have been obtained, but difficulties in the undertaking and transport made it necessary to abandon the project. The Cornish material was pointed out by Mr. Warrington Smyth, one of the Professors in the Institution of Practical Geology, and Inspector of mines to the Duchy of Cornwall. The sarcophagus rests upon a basement of granite from the Cheesewring in Cornwall. The name and date are cut upon the side panels of the lower or principal block, and the elliptical bosses at the ends are each inscribed with a cross. In the design the great desire has been that extreme simplicity and solidity should prevail, but that by a careful adjustment of the proportions any effect of rudeness should be obviated. If this combination of ideas has been impressed upon the tomb, the result is chiefly due to the assistance given me by Mr. Cockerell. The length of the sarcophagus is 10 ft. 3 in., the breadth 5 ft. $1\frac{1}{2}$ in., and the height about 6 ft. 6 in. It was cut out of a single stone which was just of sufficient size. After it had been scabbled into the general form, a small steam engine was erected on the spot to saw it in two, and afterwards to rub and polish it. The work of sawing the piece in two lasted day and night, with scarcely any intermission, 42 days. The whole operation took nearly two years. It was finally sent to London by the Rev. E. J. Treffry, and was received at the end of January last year. The amount paid for it on delivery was £1100. I estimated the weight of the larger stone, including a timber frame on which it was moved, at 8 tons, and that of the smaller stone at 6 tons. The sarcophagus was lowered into the crypt through one of the windows on an inclined plane. As soon as it reached the floor, the stage was taken down and reconstructed so as to elevate it to the proper height for rolling it on a level upon another short stage erected over the base of the tomb. For these stages light timbers and frequent props were preferred to heavier framing, as more convenient for readjustment. The greater portion

was of 6in. by 6 in. and 5 in. by 5 in. die square timber. The general calculation for the bearings was that the load should be equal to one-third of the breaking weight, and the result showed that it was every where amply sufficient, as there were no deflections of any large amount. From watching the behaviour of the timber under this strain, I am inclined to think that trusting two-fifths of the breaking weight would not have incurred any danger, but I should not be inclined to advise a smaller margin. In considering these proportions it must be borne in mind, that the condition of a mass moving very gradually and smoothly is the most favourable to the strength of the material, as subject neither to the increasing deflection resulting from too great a permanent load, nor to the danger from concussion resulting from weight in more rapid motion. The bottom and principal stone was lowered by means of two crabs from a jib, supported by trussed framing independently of the stage. The upper stone, which offered no convenience for inserting the *lewis* was slung by two straps passing round horns or ears left on each side, which were afterwards worked to a square shape after the manner of the Greek masons. The ceremony of shutting down the lid of the sarcophagus upon the venerable remains enclosed within it, took place April 15, last year, in the presence of the Duke of Wellington, Lord J. Manners, first Commissioner of Her Majesty's Works, and the Dean of St. Paul's. Mr. Mallcott was the mason. The cost of lowering and fixing amounted to about £120. including the timber stages, and making good the window through which it was lowered.

To return to what more particularly affects the Cathedral itself. It is assuredly a fact of great importance, that during the last few months the great central area of the Cathedral has been opened for evening services, by carrying out at last a plan which the Dean and Chapter have been desirous of achieving for the last eight years, but which recent movements in the Church put into their hands the means of effecting. These services have answered to an extent which has given great satisfaction to those engaged in it. It would appear that Sir Christopher Wren from the very first must have contemplated such a use of the interior. Even before the Fire of London, we find him engaged in a plan for forming a large central space in the old Cathedral, by removing the tower which had become dangerous; and we are told he advocated the plan expressly for the purpose of its receiving a large congregation. Again, in the model of his single order, a design preserved till lately in the Cathedral, but now at the Kensington Museum, it is quite evident that the great central space must have been the part intended for the congregation, so that the present use of the dome area is strictly in accordance with his intentions. It may be justly affirmed that it has not hitherto been used. It has, no doubt, two or three times in the century been the scene of great public memorials, thanksgivings, and funerals. And once every year it has been turned into a sort of amphitheatre for the exhibition of 4000 Charity Children; certainly a remarkable spectacle, but not sufficient to satisfy the full purpose of such a building. It therefore seems a matter of great satisfation that the present evening services have been commenced, at which upwards of 3000 persons are arranged in great comfort; and it is remarkable how well, on the whole, the voice of the preacher is heard. The pulpit is *raised* about 7 ft. and a *preacher* with a good and clear delivery, speaking *slowly* but not very loud, can be heard by the whole congregation, the most distant part being upwards of 120 ft. With respect to the fittings for receiving the congregation, doubtless in the present commencement there is much that is temporary, and cannot fail to have a mean, unsatisfactory appearance. But should sufficient funds be available, these will be gradually removed; and when handsome marble screens or other suitable inclosures take the place of the present rough barriers, ample opportunity being given to the eye of the spectator to traverse in every direction, there can be very little doubt that the appearance of solemnity from the hallowed use of the place, as well as the scale given by the furniture, will render the interior of the

Cathedral very much grander than it was before. Indeed has it not become so already, while much is confessedly incomplete? To admit of these services, the Cathedral has been warmed by Messrs. Goldsworthy, Gurney, and Co., who are also engaged in warming the Houses of Parliament. In the crypt which underlies the whole church thirteen large stoves have been placed; and the air in the crypt is warmed to a temperature of about 66°. There are twenty-three openings formed in the pavement of the Cathedral, each about 4 ft. diameter, by means of which a constant circulation is produced; some being made upcasts, others downcasts, by means of a *winsail*, so that the warm air of the crypt rises by some of these openings into the church, and by others the air having been cooled by contact with the walls, roof, and windows of the church, descends to the floor of the crypt, and thus the circulation is kept up. The flues of the stoves are carried up in the external walls of the Cathedral without any injury to the building, owing to the foresight of Sir Christopher Wren, who has everywhere provided for the due examination of the gutters and downpipes by carrying a passage in all cases under the gutters; the downpipes being carried in shafts each about 2 ft. 3 in. square formed in the hollow of the external walls, and iron steps left in the angles of these shafts. The stoves, without being forced, consume about one chaldron of coke per day: the effect is, that instead of a temperature of about 45° Fahrenheit, which we should probably have had (in a severer winter than the present at this time it would have been about 42°) we have a temperature of 57°, which rises about 2° during the time of service; and if the weather were much colder, the same temperature could, I believe, be maintained, but at a larger expenditure of fuel. All the apertures in the floor of the Cathedral are outside the part where the congregation is assembled, so that the stream of heated air which the congregation throws up is replaced by air moderately warmed, and the draughts, inevitable in so large a building, are deprived of their chilling effects, while they are greatly moderated in force. The whole expence of the apparatus, including mason and bricklayers' work, was about £1250. The floor is covered with Kamptulicon floor-cloth, composed of Indian rubber and cork, excepting the centre (60 feet) where Manilla matting has been used, with a view to its more ready removal if occasion should arise. To confine the sound of the preacher's voice, the space for the congregation is enclosed on six sides of the octagon by screens of American cloth (known as sham leather). Where the screens are placed, it is desirable, should these services become permanent, that marble screens or cancelli should be adopted, of which a good example is seen in the Duomo at Verona. Almost the whole of the congregation is seated on rush bottom chairs of a very strong description, made by Mr. Skull of High Wycombe. The cost of each was 3s. 4d. delivered. As nearly as possible, 1 ft. 8 lateral, by 2 ft. 9 longitudinal space is allowed. The gangways are reduced to a very small space, it having been found that persons are otherwise apt to stand in them, and interfere very much with the rest of the congregation. The chairs not offering so solid a resistance as pews to the congregation in entering and going out, it seems that this reduction of the gangways can be managed without any great inconvenience. The result appears to justify the use of chairs even in point of accommodation; and they certainly do not in any way interfere with the architecture of the Cathedral.

Light is obtained chiefly from a corona of about 800 gas jets, placed round the Whispering Gallery: it is sufficiently strong to render moderately small print easily legible by the congregation. The form of the sounding board is, I think, a novelty, but I am led to believe that it is an approach to the true form for the purpose. The first Sunday, when the Bishop of London preached, his fine clear and distinct voice was very much confused by the echo from the dome. It therefore became necessary to put up a sounding board to stop the inconvenience. Flat sounding boards have been most commonly tried, but they are now generally discarded. A parabolic sounding board behind the preacher has been used with a certain effect, but the advantage is limited to those in the direction of the axis of

the curve; and in these cases, action and reaction being equal, the preacher can sometimes hear the criticisms of his audience, if any should be uttered tolerably loud in the proper direction. Besides which, a shell of this description would have had but little effect in stopping the objectionable echoes. To meet these difficulties a curve was selected, which has the property of distributing uniformly in every direction so much of the preacher's voice as can be advantageously reflected. The figure is hyperbolic, the axis being perpendicular over the preacher. The diameter is 10 feet, and so much of the voice it receives is reflected as if it came from a point about four feet above the preacher.

It would be interesting to know, but I am not aware that sufficient experiments have been made to ascertain, what amount of sound is reflected from a given material. The harder the material, obviously the better the result. In this case hard, organ pipe metal has been used. I observed a marked increase of audibility of the voice at a place where the assistance of the reflected sound is obtained over a point equidistant from the pulpit, but too high to receive the reflected wave from the sounding board.

The total cost of these fittings, with other expenses incidental to making the building available for the services, was about £3000. It should be mentioned that the funds requisite for this purpose have been raised by a committee of gentlemen, who have undertaken to aid the Dean and Chapter in this work. Unlike most of the Cathedrals, the charge of maintaining the fabric has never rested with the Dean and Chapter, but has been met by a small fund (only just adequate to repair the damages of the weather) administered by the Archbishop, the Bishop, and the Lord Mayor; consequently the Ecclesiastical Commission has made no provision for it out of the Capitular revenues. Without inviting public assistance, the Dean and Chapter would not have encountered the considerable expenses which have been incurred; they have therefore invited the aid of a committee, in which our profession is well represented—Sir C. Barry, Mr. Cockerell, Mr. Tite and Mr. Bunning being among its members; and most kind and valuable has been the assistance I have received from them. Although the works actually necessary for opening the dome area for public worship have been accomplished, the Dean and Chapter and the Committee do not consider their labours at an end, but they look forward to spend the surplus, at present a small amount of perhaps £2000., and as much more as they can raise without limit, in embellishing the interior in the most appropriate way. I do not hesitate to say that from the moment that this prospect opened, I have had no doubt that the most appropriate would be the most magnificent that good taste would allow; no tawdry effects being aimed at, but the best materials being used and most durable methods of applying them.

Up to this time no serious expense has been incurred, except re-glazing the windows of the drum of the dome, and regilding the parts originally gilt. Messrs. Powell are engaged upon the windows; the glass chosen is of a very simple character, after a pattern in one of Palladio's churches at Venice, it being felt necessary that these windows should admit all the light possible consistent with its not being too glaring. A richer description of ornamental glass may, however, be used in other parts, especially in the windows at the East end, and in the great windows at the ends of the nave and transepts; but the embellishment of the church ought not to be confined to, or even consist mainly in glass. The chief indications of Sir Christopher Wren's wishes as to the embellishment of the Cathedral, are drawn from a note in the Parentalia. We read in p. 291, "In the aisles the lesser cupolas are both ways cut in semi-circular sections, and altogether make a graceful geometrical form, distinguished by circular wreaths, which is the horizontal section of the cupola; for the hemisphere may be cut all manner of ways into circular sections; and the arches and wreaths being of stone carved, the spandrils between are of sound brick invested with stucco of cockleshell lime, and which having large planes between the stone ribs are capable of further ornaments of painting if required. The

inside of the whole cupola is painted and richly decorated by an eminent English artist, Sir James Thornhill, containing in eight compartments the histories of St. Paul. In the crown of the vault, as in the Pantheon is a circular opening, by which not only the lantern transmits light, but the inside ornaments of the painted and gilded cone display a new and agreeable scene."

In a note to the last paragraph we find the following information, "The judgment of the surveyor was originally, instead of painting in the manner it is now performed, to have beautified the inside of the cupola with the more durable ornament of *Mosaic* work as is nobly executed in the Cupola of St. Peter's in Rome, which strikes the eye of the beholder with a most magnificent and splendid appearance, and which without the least decay of colours is as lasting as marble or the building itself. For this purpose he had projected to have procured from Italy four of the most eminent artists in that profession. But as this art was a great novelty in England, and not generally apprehended, it did not receive the encouragement it deserved. It was imagined also the expense would prove too great, and the time very long in the execution; but though these and all objections were fully answered, yet this excellent design was no further pursued. The painting and gilding of the architecture of the East end of the church over the communion table was intended only to serve the present occasion till such time as materials could have been procured for a magnificent design of an altar, consisting of four pillars wreathed of the richest Greek marbles, supporting a canopy hemispherical, with proper decorations of architecture and sculpture, for which the respective drawings and a model were prepared. Information and particular descriptions of certain blocks of marble were once sent to the Rt. Rev. Dr. Compton, Bishop of London, from a Levantine merchant in Holland, and communicated to the Surveyor, but unluckily the colours and scantling did not answer his purpose, so it rested in expectance of a fitter opportunity; else probably this curious and stately design had been finished at the same time with the main fabrick."

A baldachino over the communion table we do not perhaps require, but that is no reason why coloured marbles should not be introduced: we know we can have them both from abroad and from our own country, and they may be most advantageously applied in the panels; and why should we despair of carrying out the desires of Sir Christopher Wren in respect to the mosaic decoration? There is no difficulty—The island of Murano in Venice still produces the material, not inferior to the ancient, even if our own manufacturers do not surpass or equal it. I know that Messrs. Powell are striving to produce this beautiful manufacture: the method is understood,—certainly it is slow,—but there is no mystery about it. I cannot conceive that there ought to be any insuperable difficulty in making this magnificent interior of Wren's Cathedral brilliant with this forcible but quiet manner of colouring; and the cost of the undertaking cannot be beyond what might fairly be hoped to be contributed in London, many of whose merchant princes could singly do it without impoverishing themselves. I believe that £7000. or £8000. expended in mosaics, would go far to make the drum of the cupola all that could be desired in point of ornament. This would be a commencement, which, if successful, (I do not for an instant question its success,) would most likely lead the way to greater things; a school of workers would have been formed, and the noble spandrils of the eight arches of the dome, and the hemispherical vaults through which the vaults of the aisles are pierced with so much beauty, would offer fit places for more elaborate designs and subjects from Scripture history. This accomplished, there would still be work to do; but by the time thus much should have been done, there would be materials enough collected to form the subject of another paper to be submitted to the consideration of the Members of this Institute.

Mr. H. H. Burnell, Associate, said that Mr. Benj. Wyatt, in his pamphlet on Theatres, stated

from experiments that the voice was heard distinctly at a distance of 75 feet in front, and on the side of the speaker, but only 30 feet behind him.

Saunders's book on Theatres was also mentioned by several members, as containing the particulars of a large number of experiments on sound. The Chairman, Mr. Ashton, V.P., observed that he had distinctly heard the voice of the preacher at Westminster Abbey, when standing at the Western door, at a distance of about 115 feet from the pulpit.

Mr. Parris, Visitor, said that while suspended within the upper part of the dome at St. Paul's, he could hear even a whisper from the level of the pavement, 220 feet distant. When he shifted his position to a higher point under the eye of the dome, the effect was not produced. He had observed that the reverberations of sound in a dome were always repeated exactly 32 times. A speaker placed near the vault of the dome could be heard at the level of the pavement, there being no difference between the ascending and the descending sound. Mr. Parris felt bound to thank Mr. Penrose for the very handsome and unexpected manner in which he had referred to his labours at St. Paul's.

Mr. A. J. Baker, Associate, referred to a paper on Sound in a recent number of the Builder, as accounting for the value of a flat reflector over the speaker's head. If it extended a sufficient distance, the voice striking upon it would follow the direction of the surface, instead of being at once reflected at the same angle as that of incidence, as a ray would be in a mirror. The circumstance of the speaker hearing the reflected voices of the audience was illustrated at St. Pancras Church, where the clergy in the apse could sometimes hear the whispering of the children in the gallery at a distance of more than 100 feet.

Mr. O. Hansard, Associate, called attention to the neglected state of Wren's model of St. Paul's in the South Kensington Museum. He believed there was an understanding that it would be repaired when it was lent to that museum.

An opinion having been expressed that a large collection of drawings of the scaffolding and machinery used in the erection of St. Paul's was either at All Soul's College, Oxford, or in the possession of the Dean and Chapter of St. Paul's:

Mr. Ashpitel, Fellow, said that Wren's drawings at All Soul's College were excessively clever and worthy of study. He was not aware that they illustrated the scaffolding or machinery employed, as they consisted chiefly of the original studies and designs for the Cathedral. Wren's mode of proceeding was to sketch out first in pencil, on a moderate scale, the plan and elevation, and then to set them up roughly in perspective with pen and ink, and a little bistre. It appeared that he altered, rejected, and set these designs up again and again; and the drawings furnished a most extraordinary and instructive study.

Mr. Godwin, Fellow, bore testimony to the admirable taste displayed in the recent arrangements in the centre of the Cathedral, although many were only temporary. He begged to express the hope that the well-known epitaph or inscription to Wren would be speedily restored. It had become part of the history of the Cathedral and of London; and the numerous letters he had received on the subject convinced him that it was a very unfortunate thing that it should have remained so long out of its place. With respect to the decoration of the Cathedral he thought, with great deference to Mr. Penrose, that the very large inscription round the drum of the dome, shewn in the drawings, would be anything but successful in effect, and that the tall letters would reduce the scale of the Cathedral considerably. No doubt, great consideration would be given to the whole subject; and it must be remembered that the management of colour in decoration was a most difficult professional question.

An allusion to the inscription round the dome of St. Peter's, in which the letters were nearly six feet high, occasioned some diversity of opinion as to the actual result.

Mr. Lockyer, Associate, thought that letters of small size would be comparatively insignificant when seen from below. He concurred in the proposed employment of mosaics. Though very expensive, their imperishability would fully compensate for the first cost. The frescoes and oil paintings executed in Italy, 500 or 600 years after the great works in mosaic, were now in such a state that it was impossible to make out the details; while the mosaic decorations of the apses of the early basilicas (from the eighth to the twelfth centuries) remained still perfect.

Mr. Fraser, C. V., thought the objection of Mr. Godwin arose merely from the circumstance that the letters of the inscription were a little too prononcées in relation to the tone of the drawing. They were made to appear very dark and prominent, while at St. Peter's the inscription did not by any means attract the eye, unless it was directly looked at.

Mr. T. H. Lewis, Associate, differed from that opinion. Indeed, all the details of St. Peter's were on so large a scale, that the real magnitude of the building was lost sight of on first entering it; and it appeared very considerably smaller than it really was. The figures of children on the stoups at the entrance were, he believed seven feet high; and being exactly like children in every other respect, they gave a scale to the building, and diminished the effect of size. It looked very much smaller than it would if it were treated in the Gothic manner of our own Cathedrals, with ornamentation on a small scale.

Mr. Marrable, Fellow, agreed with Mr. Lewis as to the first effect of St. Peter's, but observed that future visits soon shewed the fitness of every object for its position, and at last the mind became fully impressed with the gigantic whole. The proportions of the different parts were so nicely adjusted that the spectator at first lost all knowledge of their size. This, however, grew upon the mind as soon as he became accustomed to the just proportions which prevailed throughout the building. He saw nothing obtrusive in the inscription round the dome; and the figures on the font, whatever their first effect, served afterwards to strengthen the impression of the gigantic size of the whole building.

Mr. John Bell, Visitor, had no doubt that Mr. Penrose would try a sufficient number of experiments to ascertain the effect of colour, and of the proposed inscription. Everybody must agree that St. Paul's Cathedral should be decorated with colour. It was a most noble building, which should not be allowed to halt half way, as at present, between conception and completion. The Life of St. Paul would afford a number of subjects never yet taken up by painters, and most appropriate for the purpose. If painters could have at St. Paul's an opportunity for the display of Sacred Art, as they had at the Houses of Parliament for that of Historic Art, it would be a vast advantage to the Arts of this country.

Mr. Kerr, Fellow, said it was an interesting point of study whether a large building should be treated on a small scale, so as to produce an immediate impression; or upon a grand scale, so as to allow that to grow upon the mind by degrees. Each of these two modes of artistic treatment was not only legitimate but philosophical; and the large scale treatment of St. Peter's and the small scale one of St. Paul's might be alike admirable. Of course, the future decoration of St. Paul's must proceed upon the scale commenced by Wren. The decoration in the section by Gwyn was objectionable from his having adopted the large scale of St. Peter's. Mr. Kerr could not allow the opportunity to pass without alluding to the extreme gracefulness of Sir C. Wren's designs. It was most remarkable that a mathematician should come to the profession of architecture, and produce designs unmatched for grace by anything in the world. The dome of St. Paul's, as seen from the river, might vie with anything which the whole realm of architectural art could produce.

Mr. Donaldson, H.S.F.C., said, the profession ought to hail with great satisfaction the movement to carry out the proper decoration of our central Protestant Cathedral; a matter in which we ought not to fall short of any other nation or section of Christianity. He trusted it would be completed as the architect had contemplated; but if finished in a manner commensurate with the design, a large expenditure must be contemplated. The inscription shown in Mr. Penrose's drawing occupied a different position from that in St. Peter's. In the latter, the inscription filled up the frieze, whereas in the drawing it was placed upon the lofty stylobate of the dome. He should regret to see any inscription on that part of the building, where nothing should supersede the high art decoration for which it was so well adapted. The employment of colour in the windows would have a great influence on the internal aspect. They ought to be filled with stained glass, which would give great dignity, and a glow of feeling and warmth to the whole; contrasting strongly with the coldness derived from the light passing, as at present, through clear, transparent glass. Coloured marbles would also produce a great deal of embellishment; and Mr. Bell, with all his respect for the talent of his predecessors, would feel that the Monuments did not adequately fill the positions they occupied. Mosaics formed undoubtedly a most enduring mode of decoration, but unfortunately they were very costly. The Government establishment at Rome for the production of mosaic pictures and other works of art was maintained at a cost that would never be contemplated in this country. Many other sources of decoration were, however, open, and reliance might be placed on the taste and knowledge of Mr. Penrose; and that, if sufficient means were placed in his hands, he would apply appropriate embellishment to St. Paul's. He thought the proper scale of decoration had been employed at St. Peter's, and that the figures of children, which had been mentioned, would be insignificant if they were only of the natural size. It was true that the first effect of St. Peter's did not convey the idea of its magnificence and grandeur; but on ascending to the cupola, into the drum over the inscription, the full effect was realized. The inscription was merely subordinate and it did not assume any dominating effect. From the gallery under the drum of the dome, and over the arches, looking upwards into the cupola filled with mosaics, and looking downwards to the vast size of the baldacchino and the statutes in mid-air, the best point of view was obtained. In the same way he considered that the Whispering Gallery was the best place from which to form an adequate idea of the magnitude of St. Paul's. It was matter of regret that the entablature of the lower order of the interior of St. Paul's had been cut through. If the arches had been lower, and the entablature carried through, instead of the mere cornice, there would have been much greater consistency, and a superior result. Wren had left many projecting blocks of stone, and other spaces, purposely for decoration; and the little cupolas of the nave and aisles were left plain, with a surface of plaster for the same purpose. The upholstery style of decoration shown by Gwyn's section betrayed the casual ideas of an inadequate artist; but, visiting St. Paul's as he did every year, he could bear testimony to the great accuracy of that section in every detail.

The Chairman observed that members of the profession, having the care of great public monuments, could do no service more valuable to their brethren than by devoting a portion of their time like Mr. Penrose, to bringing before the Institute some information respecting those buildings.

The motion of thanks to Mr. Penrose having been carried unanimously, the meeting adjourned.

ON METROPOLITAN IMPROVEMENTS AS AFFECTED BY THE BILLS NOW BEFORE PARLIAMENT.

By T. M. Rickman, Associate. Read at the Royal Institute of British Architects, Feb. 21st, 1859.

One of the most systematic examinations of the principles of metropolitan improvements was conducted by the "Metropolis Improvement" Commission, which made its first report in 1844. Two sentences from the opening pages are of great importance. Respecting the plans submitted it is said: "The utmost attention will be required in selecting such of them as may appear to possess the highest claims, and at the same time to be within the limits of practical and not too expensive execution." The other refers to Sir C. Wren's proposed recast of the metropolis. "His attempts were thwarted by public bodies and individual interests;" and it is added, "the consequences of the fire of London, as regards the disposition of the city, were but to accelerate the Westward movement of the nobility." . . . . "The extension of the town is the work of private enterprise, but the openings of internal communication must be effected by public aid."

For a long time improvements, to a small extent, in the city had been conducted by the Corporation. The necessity for a bridge at Westminster was considered local, and not metropolitan. It was completed in 1750, with funds partly raised by a lottery. About 1795 the same means were adopted for throwing open Snow Hill, and the site West of Temple Bar. Blackfriars Bridge, or "Pitt's" Bridge, finished in 1769, was paid for by a toll, continued for a number of years. Waterloo, originally "Strand" Bridge, was erected by a private company, and opened in 1817; Southwark Bridge by similar means in 1819. In connection with it was the opening of King Street and Queen Street. Hungerford Bridge was opened in 1845. The great improvements at the West end were carried out at the ultimate expense, in great part, of the Land Revenues of the Crown, with a large aid from the Consolidated Fund. London Bridge was opened in 1831, and the present coal tax assisted, in a great measure, in the completion of the approaches. The tax has since been expended in the formation of other streets, and has hitherto been considered the sole pecuniary means of effecting "metropolitan improvements." The City Corporation Commission, which aided in the introduction of the "Metropolitan Management Act," reported against that tax, and in favour of one to be levied on the whole metropolitan district for the purpose of improvements. The coal tax lasts till 1862: it is entirely hypothecated. Till other funds are forthcoming, or the new tax established, no extensive improvements can be carried out.

In the year 1813 the "Commissioners of Woods, Forests, and Land Revenues of the Crown" made their first triennial report, after their connection with the "Board of Works," on the state of the property confided to them, with a statement of their proceedings. One of the first points to which their attention had been directed, was the improvement of the Marylebone Park Farm. The offer of a premium of £1000. not having produced any design calculated to effect the desired result, Messrs. Leverton and Chawner, Surveyors to the Office of Woods, and Mr. Nash, one of the architects to the Board of Works, were requested to furnish plans. The former sent in a design for laying out the larger part for building purposes; the latter one which gave a much more extensive area to the public, and combined the erection of terraces, villas, markets, and streets on the Eastern side, with a new street to Pall Mall, in a line with Portland Place. This, or Regent Street, as at first planned, terminated in a square, inclosing a public building. This arrangement, principally from want of means, was changed into the present Quadrant, after the execution of the main sewer, which consequently, in some places, runs under the houses. Regent Street was opened in 1819. The total cost in 1826 was

about £1,315,000., of which £515,000. was paid from the Crown Revenues, and £800,000. from the Consolidated Fund. The annual income was £36,000., but ultimately it will be £160,000. The nett cost of laying out the Regent's Park, which was defrayed out of the Crown Revenues, was stated in 1823 to be £20,000.

This great artery having been opened, and the lung formed—the Regent's Park—the Commissioners proceeded in their labours Eastwards. Mr. Nash's plans for continuing Pall Mall to St. Martin's Lane gradually grew into the formation of Trafalgar Square, and the buildings on its East, North, and West sides, with the district between the Strand, Agar Street, and the South side of Chandos Street. Some progress was made in the continuation of Pall Mall in 1823, and shortly afterwards the growing attraction of the British Museum was adduced as a reason for widening St. Martin's Lane; but this improvement was only carried out as far as the corner of Chandos Street. The report of 1826 describes the passing of an Act to widen the Strand, the new works in connection with the Charing Cross improvements having rendered the Northern side of that thoroughfare an eye-sore. An Act passed in 1826 (the Charing Cross Act), included powers for improvements in Downing Street, and King Street, Westminster. In 1835 the whole of the purchases had been completed; the Land Revenues having paid the cost, which was ultimately £1,196,000., except £600,000. still due to the Consolidated Fund. Of the above sum £1,058,000. may be set down to the improvements at Charing Cross.

Two results ensued from the lavish expenditure on these great works. It was desired to extend the improvements, but it was not thought fit to continue the unlimited system of borrowing from the Consolidated Fund to supply the Land Revenues of the Crown. The widening of the lower part of St. Martin's Lane, with the view of opening up a communication from Charing Cross Northwards, pointed to Long Acre as an intermediate Westerly route, and its continuation Westwards through Leicester Square to Piccadilly was seen to be of importance. The opening of Waterloo Bridge in 1817 pointed out the improvement of Bow Street, and the formation of Endell Street. The straightening of the Oxford Street and Holborn route, by cutting New Oxford Street, seemed most desirable to improve the Northern East-West route, and the opening of Bloomsbury Street to connect Endell Street with St. Martin's Lane, and the clearing away the middle row and projecting buildings at the head of St. Andrew Street in Broad Street, St. Giles, followed as the result; and, while so much was proposed to improve the East-West routes, on the Middlesex side, it seemed but proper that a new parallel route on the Surrey side should be projected to connect Westminster Bridge with Southwark. Mr. Nash had prepared plans for Cranbourne Street and New Oxford Street, but the state of the Crown Revenues, in consequence of other large operations, prevented any works of importance in this direction from being carried out for some years, except those connected with Wellington Street and Bow Street, which were effected to a great extent by arrangements with the adjoining owners; but in 1839 the Commissioners reported that all the new streets authorized by Parliament had been completed, and the debts paid; that the growing produce of the Crown estates would be paid to the Ways and Means, and the produce of sales invested.

In 1836 and 1838 committees of the House of Commons were engaged in examining the plans which had been brought forward, and in ascertaining the funds available, and the expense likely to be incurred. The last committee reported in favour of three routes. 1. Cranbourne Street and Endell Street; 2. New Oxford Street; 3. Spitalfields: consequently in 1839 an Act was passed authorizing the construction of these streets, and granting for that purpose a charge upon the London Bridge approaches fund of £200,000. In the following year, the Commissioners finding the amount voted far too small, came to Parliament, and requested either to be restricted to one of the plans, or to be allowed more money; and in conformity with the recommendation of the Select Committee of

1840 on this subject, an Act of the same session was passed, continuing the coal tax for four more years for this purpose. In 1844 Cranbourne Street, and in 1845 New Oxford Street, Endell Street, and the new street, Spitalfields, were opened, at a total expense of £841,000., though on a reduced scale. In 1842 a Commission was appointed to inquire into the most effectual means of improving the metropolis. The first report appeared in January, 1844, and others from time to time till 1851, when the seventh and last was issued. The completion of the Spitalfields line through Whitechapel to Christ Church, and the important vegetable market, had rendered it still more desirable to continue the line of street to the Eastern Counties Station, and on to the City Road. An Act was therefore passed in 1846 enabling the Commissioners of Woods to construct the first portion of the work. The funds were to be supplied from the 1d. duty on coals. This duty had been first levied to pay the expenses of the new Coal Act, the erection of the Coal Exchange, &c., but as those objects had been accomplished, and the execution of this work was pressing, its application to this purpose was guaranteed by the Act of 1846, but it was not till 1849 that the Commissioners could raise money upon this duty to carry out their undertaking: the whole was formed by the Commissioners of Woods, with the aid of mortgages on the spare land, and the street was opened in 1858. The continuation to Old Street and the City Road now lies with the Metropolitan Board of Works. In 1844 the opening of Albert Gate was completed, partly at the expence of the Land Revenues of the Crown, and partly by arrangement with Mr. Thos. Cubitt. In 1851 the opening in front of Buckingham Palace, and the removal of the Marble Arch, were effected; and from that time to the present the entrance to St. James's Park, from the Victoria Road and Belgrave Place, has been progressively enlarged.

Victoria Street, Westminster, was opened in 1852 with the aid of considerable grants from the coal duties, &c. The difficulties which the Crown did not feel have fallen heavily on the Westminster Improvement Commissioners. The lessees who undertook Park Crescent failed, but the Crown obtained others; whereas the Westminster Commissioners advanced heavily on the buildings in Victoria Street (it is said to the extent of £400,000). Their administration has been questioned, both as to the withholding of accounts, and the issue of bonds without security, and their affairs have become food for the lawyers. The creditors refused two years ago the Bill proposed by the Commissioners, and there are now two rival Bills for effecting similar objects; one for authorizing sales through the medium of the Court of Chancery, the other for a reconstruction of the Commission on an equitable basis.

The construction of Victoria Park and Battersea Park illustrates another phase of public improvements. On the death of the Duke of York, the lease of the house which he had built, being heavily mortgaged, was bought by the Crown. In 1827 it was sold to the Marquis of Stafford for £72,000. but as an assignment could not then be made, the money was vested in trustees, and remained out at interest till 1841, when it amounted to £115,683. An Act having been passed to enable the Commissioners of Woods and Forests to purchase and form the Victoria Park, this sum was applied to the purpose, and the remaining expense, about £14,000., was defrayed out of the Revenues of the Crown. The area purchased was 266 acres, of which 45 are retained as building land, and let by the Crown. The purchase of Battersea Park was authorized by an Act of Parliament in 1846. The funds were to be advanced by the Exchequer Bill Loan Commissioners to the extent of £200,000.: it was calculated that this sum would be sufficient, and that the return from the building land purchased at the same time would eventually repay the whole cost. It was a good time for purchasing land in that district, but from the irregularity and long delay in the advance of the requisite funds, the land increased in value, and in 1853, when the purchases were completed, the cost, including formation and expenses, amounted to £316,000. The total area of land purchased was 319 acres, of which 125

are building ground. The whole of the Park is made ground, the bed of the ornamental water being about the level of the original ground. Closely connected with Battersea Park is the erection of the new Chelsea Bridge. The design, like that of many of our bridges, has undergone numerous changes—wood, stone, iron, suspension. The Act, empowering the Commissioners of Woods, &c. to carry out the embankment of the river connected with this work, dates 1846. The Improvement Commissioners made their sixth and last report in 1847, and devoted it to this subject. Great endeavours were made to effect the embankment by private arrangement; but up to the present time the conflicting interests of private individuals have succeeded in thwarting the extension beyond Chelsea College, and the powers of the Act have expired. The bridge was long delayed through the failure of a contractor, but was opened in the spring of 1858.

The first subject on which the Improvement Commissioners reported was the embankment of the Thames. In 1844 they referred to the change which the river had undergone from the removal of old London Bridge, authorized by an Act of 1823, and to the irregular curves with the projections and recesses of the banks. An Act of 1678 had regulated embankments for a long time; but, gradually falling into disuse, it was repealed in 1821. Messrs. Walker and Burges laid down certain lines, which have been, theoretically, the limits of projection; but they have been practically followed only to an insignificant extent, if at all. The authority in these matters now rests with the Conservators of the river Thames. It was not thought, till 1840, that the Thames had found the limits of alteration from the change in London Bridge. Since then, many have been the schemes for utilizing the banks of the river. Since 1824 Sir F. French had been ventilating this subject. In 1844 Mr. Walker, on behalf of the Corporation, was pressing his scheme; but at that time insuperable obstacles prevented its execution. The two plans then considered the most feasible were Mr. Walker's for a broad embankment into the river, and Mr. Page's for a wall, with a roadway, retaining in many places large tidal reservoirs up to the present banks. The first would require the wharves of each proprietor to be brought forward and changed, while it would reduce the mooring ground for coal barges, which is of continually increasing extent. Mr. Page's plan, while it filled up the frontage where no trade was carried on, left openings for the vessels and the tide at many points. The conclusion of the Commission was in favor of an embankment for improving the navigation, while the importance of combining this object with the conveniences of additional land communication was considered great: the space to be thus treated, most recommended by the Commission, extended from Westminster to Blackfriars, and for that purpose an increase of 5d. per ton on the coal duty was suggested. We have now the Metropolitan Management Act, the institution of the Metropolitan Board of Works, armed with a rating power, and the re-constitution of the Conservators of the Thames—measures following in conformity with the recommendations of the Corporation Commission of 1853-4. The abolition of the privileges of the Thames Watermen and Lightermen (not a City company proper, but dating from the time of Henry the VIII.), also urged by the report, is now the subject of a smart agitation in the City.

The Corporation have always been engaged in improving the City; for since the passing of the Act after the Great Fire, which required a 40 feet way from the Temple to London Bridge, the streets have never been wide enough. New London Bridge and the Exchange have been connected by a series of fine open streets, which have ramified. The Post Office and the Bank have been likewise centres for considerable openings under different authorities; but in both of these cases the plan has not been carried out on a scale sufficiently complete to afford all the advantages which might have accrued to the public. The uselessness of Gresham Street, and the difficulty of now improving it, are instances of the want of system from which the labours of the several authorities have sprung. The noble opening of Cannon Street, at the cost of £500,000., is also waiting for a more convenient access

at the West end to accomplish the purposes for which it was designed. This street and the greater part of the last-mentioned improvements have been the work of the Corporation, aided by the coal tax. The opening of the district round the Post Office was to a great extent a Government affair, and with the Administration of that day rests the charge of having put off the purchase of the property between that building and Cheapside, and of so placing the building itself as to prevent convenient access to St. Martin's-le-Grand from the East. A valuable site for opening up this building is now being built upon. The improvements in opening Farringdon Street, forming the market, purchasing the site of the Fleet Prison, and forming the Victoria Street, have been the result of disjointed action. The Commissioners appointed to execute the latter were unable to complete their task with the means at their disposal, and it merged at last into the hands of the Corporation.

The improvements now authorized, for which sums have been provided, are:—the communication between St. Martin's Lane and Covent Garden, for which purchases are being made; a short street, exclusively in the Bedford estate, from Burleigh Street to Tavistock Street, aiming at the South-East angle of Covent Garden; the new street from Stamford Street to the Town Hall in the Borough; New Earl Street to lead from Cannon Street to the West end of Upper Thames Street; and the approach from Limehouse, at the junction of the East India Dock Road and the Commercial Road, to the South end of Grove Road, and thence to Victoria Park. The rebuilding of Westminster Bridge, with the removal of the houses on the South side of Bridge Street, and the widening of Newgate Street are gradually progressing.

Let us here take a cursory view of the requirements of London as our metropolis. Its position is on the main river of the country; upon a bend of that river, as in old times the military views of the founder dictated. The low grounds on the South side held the out-posts, the "Tête du pont," Southwark. The Tower was adjacent to the walls of the city, at a short distance from the bridge. Away to the West, the Isle of Thorney, with its monastery; opposite to it, Lambeth. This concrete has become one nucleus, and the London of the present day has arisen. Thus we have routes East and West as the main metropolitan thoroughfares. London is a town of commerce, a great depôt: commerce is conducted by shipping and by railways—hence the connection between the docks and the town and railways is of primary importance. The Thames is the great highway for London, and it bears its proportion of local traffic both for passengers and for articles of consumption. The docks require immediate connection with railways, especially for imports: they require for their export trade connection with the whole of London, by wide roads and easy gradients. All the railways, therefore, require to be linked together, and connected with the docks and river for their goods traffic, so as to avoid trans-shipment and unloading. Then as to passengers—the railway termini and the main streets must be laid out with reference to each other. In every metropolis there are two centres of interest and importance: one, the civic and commercial, where the local Government has its seat among the marts of industry, the sources of its individual power and position; the other, that of the Government and of all connected with the Throne, the aristocracy, and the administration of the country. The original relative position of London and Westminster has been the key to the class division of the metropolis. Centered at Charing Cross are the streets of the West end, and at the Bank those of the East end; in the immediate neighbourhood of each of these centres the value of property is immense; between them lies a district of secondary value, and towards the extremes the value gradually diminishes. Property is valuable in these spots because vast masses of people engaged in their proper callings congregate there. Therefore, for the passenger traffic, the railways should have termini of great capacity as near these two centres as possible, while the less valuable ground in the intermediate district points

out that locality as for occupation by the main arteries of the empire. Then these main stations, with abundance of minor stations and convenient loop lines for the use of the outskirts, ought to put the passenger traffic of the metropolis on a sound and practicable footing. This is the end towards which the efforts of the Railway Companies now tend. The North London Line, with the Blackwall and Greenwich Lines, and the West London Railway, are links in the chain of loop lines; the Eastern Counties find their account in adopting the Fenchurch Street Terminus. The Thames separates the South Eastern lines from the city at present, and the London Bridge and Fenchurch Street Stations must be considered as grouped together. The greatest efforts are now making on the part of the Southern, Western, and Northern lines, to obtain a station at Charing Cross, and if the Duke of Northumberland can be prevailed on to give up his mansion and grounds (not now what they were), the "noblest site in Europe" may be turned to proper use, and London be no longer beaten by Liverpool in the position of her central terminus. The Victoria Station for Belgravia will group with the last mentioned centre. But neither the Bank nor Charing Cross can be reached by the Great Northern, North Western, or Great Western Railways, except by long detours. Their interests are the same, their power of attracting passenger traffic greater than any others. The land lies vacant in Farringdon Street, or poorly built on in Moorfields, for their stations; and yet session after session passes without their securing a position, the key to the whole metropolis.

To return to the political distinction between the East and the West centres of London, between the City and the Court, between commerce and the legislature: as there is in reality a medium, so there should be in fact a locality devoted to their mutual action. The administration of justice and the law, while it gives the poor the advantages of the executive government, is the means of returning to the commercial classes great advantages, such as can only be purchased by a stedfast maintenance of the authority of Government and by respect to the laws of the realm. The judges of the land are the representatives of the Crown. The justice they mete is the test of the honour of the nation. The courts of law should therefore be so situated that the commerce and the executive legislature of the country should have equal access to its halls.

For improving the Eastern central stations there are no propositions. The increase of traffic is proceeding; but the divided interest in the London Bridge Railways has produced its effect, in the great endeavour on the part of the South Eastern line to obtain a better footing at the West-end than its twin brother, the Brighton line, has already obtained through the West end and Crystal Palace lines, leading into the Victoria Station. The East Kent, or direct Dover line, has arranged to run into the Victoria Station; and for that reason the South Eastern *must* come Westwards to Charing Cross, or elsewhere. There are several schemes for taking the South Eastern to the Victoria Station, by Southern loop lines; but the scheme which seems to promise most result is that called the London Bridge and Charing Cross Railway. This line, starting from the North side of the London Bridge Station, crosses over the stream of people at the South side of the bridge, bears South of St. Saviour's, and adopting nearly the line of the originally proposed new street, is connected with the Waterloo Station, and crosses the Thames at Hungerford, using the market and adjuncts for its terminus. Any one of the lines proposed to connect the West London Railway with the South Western line, would in effect give all the lines, North West, and South of London, opportunity of entering either at Charing Cross or the new Victoria Station. Beside the last mentioned line, as affecting the West central stations, there is the South Metropolitan Railway proposing a high level line from the South Eastern, through the Southern parts of Lambeth, across the South Western and the river, to the side of Victoria Street, Westminster, where a new station was proposed. But the scheme has given way before others having more influential support. The Victoria Station, and Pimlico line are now constructing: these will give as good a station for Belgravia as the Great Western has for Tyburnia. Hence the schemes, having for

object, the connection of this railway with the Western lines by a line from Kensington, either through Chelsea or through Battersea. These Western lines rest upon the West London Railway, "Punch's Line," and each scheme for adapting this railway, and its possession, the Kensington canal, also proposes to improve its connection with the Great Western and North Western lines, and to connect it with the Hampstead Junction line. So much for the Eastern and Western group of stations—for Paddington Station cannot be considered as fulfilling the conditions of a first-rate position. We come then to the central stations which should serve those lines that carry the passengers to the manufacturing districts of the North and Midland counties, to Scotland, and to Ireland. The Metropolitan Railway, and Regent's Canal Railway, are schemes for this purpose. The enormous traffic conducted at the Fenchurch Street Station shows that good management will prevent any confusion; and the advantages to be derived from a station so accessible to business men from all parts of the town, as is the bottom of Holborn Hill, if the Law Courts settle down near Temple Bar, or as the neighbourhood of Finsbury, for city men, especially for long journeys, in place of the present Euston, Paddington, and King's Cross Stations, needs no argument; nor would the advantages be less perceptible for local traffic. The decision of this conflict will decide the position of the New Post Office.

Before leaving the railways, one further scheme deserves attention, that of the Thames embankment and railway. It combines the points recommended in the Report of the Improvement Commissioners in 1844, and, though urged year after year, is still fighting its way; now with Walker's lines, now with the Wharfingers and the hay barges, and in its railway department with the "Victoria Station and Pimlico," and the King's Scholars' Pond sewer.

In conclusion, a few remarks on the various streets proposed to give passage to the traffic of the metropolis. Southwark Bridge requires a new Middlesex approach, and to be made toll free; New Earl Street requires to be continued till it reaches the embankment of the Thames and the "Quai de la Grande Bretagne;" or else to be stopped by St. Paul's Bridge Road. The routes to the docks by Tower Hill and Commercial Street require opening; the Spitalfield's Street requires extension to Old Street, and, in connection with this, a continuation of Hart Street and the Oxford Street thoroughfares through the Northern confines of the Charter House; the declivity of Holborn Hill must be overcome; the Mall requires opening into Charing Cross; and a road should be formed across Hyde Park and Kensington Gardens: these and many other improvements are urgently required and have been suggested by many persons, from Gwynn downwards. The success of either the "Regent's Canal" or the "Metropolitan" Railway will greatly influence the amount of traffic at the East, and the effect of the Charing Cross or Victoria Station, or both, as Western centres, will also be greatly felt: all must admit that this conflict, waging at both ends of London, is a subject of the utmost interest to the profession. We cannot have a straight street from St. Paul's to the Queen's Palace in the centre of Hyde Park; that was the dream of Colonel Trench and Philip Wyatt, in 1827; but we can have such a central thoroughfare as shall carry the traffic from Piccadilly direct to the Eastern focus, opening up the only fit district for the Law Courts, in such a manner that Cannon Street shall be no longer a pudding-bag, and St. Paul's an obstruction to the traffic. Take down the block of buildings between St. Paul's Churchyard and Old Change; give St. Paul's School a site in Doctors' Commons, in exchange for a thorough opening of the Church Yard; and let the hallowing influence of the place upon the living, when they have some chance of admiring its beauties, atone for the utilization of the sacred precincts. Whatever is done, let it be considered with reference, "Usui civium, decori urbium," and not be apportioned to the clamour of a metropolitan constituency.

A vote of thanks having been passed to Mr. Rickman, the discussion on his paper was adjourned to the next meeting.

ON METROPOLITAN IMPROVEMENTS, AS AFFECTED BY THE BILLS NOW BEFORE PARLIAMENT.

A Discussion at the Royal Institute of British Architects, March 7th, 1859.

Mr. Rickman, Associate, said that one of the most interesting points connected with the subject was the Junction of the Railways on the North side of London with those on the South. This it was proposed to effect by a line promoted by the West London Railway, and approved by the North Western and the Great Western Companies. Continuing the line of the West London Railway by means of the Kensington Canal, which belonged to that line, and then crossing the river, it would be connected with the South Western, and the West End and Crystal Palace Line; and thus with the Victoria Station at Pimlico. With respect to the Improvement of the Metropolitan Communications, at present a divided authority exists in the Board of Works, the Commissioners of Sewers, and the Railway Department of the Board of Trade. The arrangements for new streets were governed by the lines of sewers, and were affected by the lines of the railways and the position of the termini. London, therefore, could not be properly treated as a metropolis, unless the three Boards now controlling these important subjects were combined.

M. Hector Horeau, visitor, considered the subject before the meeting to be not only of the greatest importance to the reputation of the profession, but of much social interest, as tending to afford employment to the working classes. In no city was the circulation of traffic more broken or encumbered than in London, whilst its amount was increasing more rapidly than that of any other place. The streets and bridges were narrow and insufficient. The latter generally had bad approaches, and encumbered the river by the smallness of their arches. A grand general plan should be prepared, showing all the improvements required; and this would render their accomplishment more easy and economical. It could not be the work of one man; but if the work of many, it might be brought into proper shape by the "Institute," which could not have a more fitting task. M. Horeau urged the expediency of abattoirs outside the metropolis, the prohibiting the nuisance of live cattle in the streets, and advocated the embankment of the river, in order to gain for profitable use the present mud banks, especially between Somerset House and Westminster Bridge. A well managed municipal loan, or an *octroi*, might produce funds which would be increased by opening (without crowding) some of the parks, which at present diverted much traffic from its direct route. This might be termed *encroachment*, but it would really benefit the working classes, by supplying the means of improving their streets and dwellings, still leaving them spacious boulevards through the existing parks, for air, exercise, and recreation. By some means or other the bad streets and narrow bridges of the metropolis must be improved, and more imposing public edifices erected than those at present standing.

Mr. Heywood, Fellow, said the subject under discussion was so large that no one could give any consideration to it without finding its enormous difficulty. Mr. Rickman's map proved the utter want of forethought on the part of those who had hitherto been allowed to rule our municipal improvements. The lines upon it were exactly such as might have been traced by a spider, escaped from an inkstand. He was no advocate for the American system. Square blocks of streets were no doubt somewhat convenient, economical, and conducive to health; but he preferred "London as it is," to living in a town with streets told off by A, B, C, or first, second, third, &c. A medium, however, might be devised between the rectangular system and the miserable net-work of modern London. Within the present century only two really great improvements had been carried out;

Regent Street, and the New London Bridge, with its approaches. These were great works (effected before the railways had taught recklessness in hacking and cutting down), and their projectors deserved the greatest credit. In spite of the now crowded traffic, the approaches to London Bridge must still be considered a great metropolitan improvement. Cannon Street he considered only a local improvement. The *West end* centre line of communication and the *City* central line having been thus provided for, it appeared to him that the next great fundamental want had been entirely lost sight of;—namely, a line to connect the one of these with the other. He was not sure that even this great want was not subordinate to that of *throwing open* the whole of the *toll bridges*. At present no one could say what the traffic would do for itself if unimpeded by these obstructions. This measure, he had no doubt, would immediately relieve London Bridge of one-third of its traffic, and in a very little time even more, thus avoiding the expenditure of £40,000. in spoiling the bridge, as had been proposed, and rendering the approaches more crowded than at present. All the small measures that had been projected would only add to the difficulty and expense that must at last be met, and rather than adopt them he would let London Bridge become impassable, in the hope of having Southwark Bridge thrown open, as it might be for £250,000. Of the new streets required, the first, as already intimated, was one which should commence about the Bank, proceeding between Oxford Street and the Strand towards Hyde Park; and then, the bridges being opened, time might be allowed to see what course the traffic would take for itself, and what might be required next.

With regard to the railways, as connected with the metropolis, he thought that, as in all other improvements, this branch of the subject had been too long deferred. The late John Martin, the painter, a man of extraordinary power of mind, had long ago projected a system of railways round London, very much like that which was being carried out. But Martin lived half a century before his time. His great schemes had been deferred till they were far more costly than they would have been when he proposed them, and were now being carried out much less efficiently; because, instead of being accomplished as parts of one system, the lines were formed to suit the particular views of different companies, and the public lost the benefit both of cheapness and time in transit, from the disadvantageous positions of the respective stations. He would not advocate concentration. Two bridges of 50 feet wide would be better than one of 100 feet. Those who were officially compelled to stop the traffic of the street knew, as he did, that such stoppages were not at present likely to be avoidable; and they also knew the inconvenience of stopping a huge traffic without the means of diverting it into another channel. The plan of bringing the Northern railways to a station in the valley of the Fleet was admirable in many respects, but he should prefer *three* termini to *one*. The width of Farringdon Street, great as it was, would not be sufficient for the continual collecting and discharge of traffic all day, and another more Eastern terminus was desirable. He thought there could not be a better plan than that of taking the line of the Regent's Canal and continuing it to as near the Bank as possible. *New* streets rather than *wide* ones—in order to give *alternative* lines of communication—were the first requisite; railway communication across the Thames, and the improvement of Holborn Hill were secondary points. He hoped the Board of Works would not spend upon the latter object the quarter of a million proposed, which would be *much better* employed in opening Southwark Bridge. The Thames embankment would give to London that grand feature of embellishment which it so much required, but at the same time it would be more splendid than useful, and would not render any of the improvements he had referred to unnecessary. The Board of Works should contemplate the question in a broad spirit, and not make streets *now* which in a quarter of a century would be useless. The subject should be dealt with *irrespective of cost*. The metropolis was rich enough to find the necessary funds. Excepting the improvements defrayed from the Crown Revenues, all the great modern works had been done by the Corporation of London. He

believed that the Metropolitan Board of Works, embodying as it did from its constitution the spirit of parochial economy, as commonly understood, would never be able by the system of direct taxation to carry out the great streets that were necessary, in the way the work should be done to supply the necessities of the population. The Main Drainage must be accomplished, and there were at least two spots shewn in the map which were fairly entitled to their Parks. Considering these, in addition to opening the bridges, new streets, and increased railway accommodation, he was quite certain that ten millions of money would not accomplish all that was required. The widening of Cannon Street, and the rebuilding of one side only, had cost the Corporation three quarters of a million, after allowing for the improved ground rents. This however left them the vacant ground at St. Paul's. The cost of metropolitan improvements should only be spoken of in *millions*, for the streets he suggested, from the Bank to Hyde Park Corner, must cost nearly or quite a million a mile. The great Continental improvements, he believed, were never the result of direct taxation. In France they had the *octroi* duty; and the much abused coal tax in our own metropolis (which he hoped would not be abolished) bore upon an article consumed by every one, and was collected at very little cost by a body which had been in organized existence for a couple of centuries. It bore a direct proportion to the means of all; for the coals a man burnt was as fair a measure as possible of his expenditure. Its amount was only 1s. 3d. per ton, but it produced, without unpleasantness in collection, £240,000. a year. By doubling or trebling this an enormous fund could be provided; but if the coal tax were taken off, as proposed, in 1860, no persons but brewers and other large consumers—the only classes who at present opposed it—would be materially benefited by the change, and the fund from which the great modern improvements had been made would be lost. To a serious thinking mind the growth of London was becoming fearful! They had not the ignorance of their forefathers as an excuse—they well know from the calculations of the last half century, including periods of war and pestilence—that the population of London doubled itself in 37 years. The enormous surface to be covered by the future population was a very serious matter for consideration; for as the distance of the suburbs from the centre increased so must the use of carriages increase, until the present London streets would be in one huge state of stricture. No police regulations for traffic, nor any expedient for widening existing bridges by overhanging footways, could do any real good; and whilst the value of property required for new streets was daily rising in value, procrastination must increase their cost enormously. In addition to the coal tax, he thought the tax on carriages might be equitably and fairly given to the improvement of the metropolis. There might be a great struggle for it, but it could not be resisted even by the House of Commons. He believed the time was coming when the enormously increasing population of London must find other centres; but if so, it must be from the impossibility of getting to the large centres in the network of *alleys* shewn on the map, for, in relation to the wants of the population, the streets of the metropolis were really *nothing but alleys*.

Mr. Pocock, Fellow, said that having studied the subject for the last 25 years, he agreed with Mr. Heywood's principle of distributing rather than concentrating the traffic; and he had the acknowledgement of Mr. Lambert Jones, that, in the approaches to London Bridge, that principle had been too much overlooked. About the Mansion House, especially, all the streets converged to one point, leading necessarily to great confusion. He concurred in the propriety of throwing open the toll bridges, and felt that an improvement in Blackfriars Bridge was equally essential, for at present the heavy traffic from the Surrey side went over London Bridge to St. Paul's and its neighbourhood, to avoid the acclivity of Blackfriars Bridge. On the same principle he begged to differ with Mr. Heywood, as to the improvement of Holborn Hill. The heavy van traffic, from London Bridge Station to the Great Western Railway and the North and North Western parts of the metropolis, now passed from Fleet Street through Fetter Lane or Chancery Lane, instead of taking

its legitimate course from Cheapside to Holborn Hill; and the formation of a level from Skinner Street to Holborn Hill would keep this traffic in its natural route, and prevent the blocking up of Fleet Street and the Strand. Mr. Marrable's plan for the Holborn viaduct had the advantage over the other scheme, of enabling the cross traffic to pass *under* the viaduct; and if Blackfriars Bridge were to be improved in its gradients and the declivity of Holborn Hill done away with, the present confusion at the foot of Ludgate Hill would be very materially diminished. The street from East to West proposed by Mr. Heywood was of great importance; but in the city itself another vast improvement might be made by widening the line of Gresham Street, at present almost impassable, and extending it Westward by removing the Blue Coat School to the fresh air of the country. Money should not be spent in widening streets, but in making entirely new lines, with double instead of single frontages, which rendered it practicable to deal with much less valuable property; and this applied to the line from Skinner Street to Gresham Street, which if carried out would relieve Newgate Street. The line from Liquorpond Street to Old Street, or some other line, was necessary to relieve Holborn. The Bank would always be a focus of traffic, and also Charing Cross; but a great deal of traffic which had no business there went to those places, simply because no other routes were open to them. London Bridge was not merely a great metropolitan thoroughfare, but it was the main line connecting Kent and Essex. Much traffic passed over it which need not go into the city at all, or at least might as well go over Southwark or Blackfriars Bridges.

Mr. Richard Bell, Fellow, although differing in many respects from Mr. Heywood's views, thought the meeting indebted to that gentleman for the ability with which he had treated the subject. One of his ideas, however, was impracticable; for London improvements could not possibly be carried out *irrespective of cost*. The purse even of a nation must have an end; and it would be impossible to carry a street through such property as that which was lately bought in Cornhill at the rate of £346,000. an acre. No great London street had been formed more cheaply or with a better return for the outlay than Moorgate Street, which had cost £67,000. per acre. It was always necessary in making a new street to purchase more than double the width of the ground required. Moorgate Street had the advantage of cutting through the cross lines at right angles, the principal expense being at Lothbury. The Corporation took all they wanted, and all they took they used, both front and rear. In such a case as the widening of Cannon Street, it was often necessary to purchase a depth of 140 feet, when perhaps only 20 feet were required. There had been a desire to carry the new Cannon Street along the old line of Watling Street, but the value of the property in the latter line was so immense that it was impossible to find any funds to meet such an undertaking. New streets generally should cross the older lines at right angles rather than diagonally, but although King William Street was a departure from this rule, yet, leading to the Bank, Princes Street, and Moorgate Street, it was a most important line of communication to and from London Bridge. The opening of Southwark Bridge would have this disadvantage—the traffic over it Northwards, being blocked by Guildhall, would cross and impede the already crowded traffic of Cannon Street and Cheapside. He was a great advocate for the improvement of the Quay of the river; but this again was a question of cost. For thirty years past nearly three millions a year had been expended on metropolitan improvements, which, comparatively speaking, had been invaluable; but in order to carry out the improvement of the quays of London the best method would appear to be the adoption of a sort of sliding scale; and to purchase the reversionary interest of the freehold property along the sides of the river to the necessary extent. If a well digested plan of this kind were laid down, money might be judiciously invested, so as to secure the possession of part of the property in 40 years, and another part in 80 years. At the same time he should deprecate any encroachment on the water way: he would indeed hardly allow a walking-stick to be placed in the

Page 82—8*th line from the bottom.*

Instead of "For thirty years past nearly three millions a year had been expended on Metropolitan Improvements,"—

read "Upwards of three millions in thirty years had been raised by a duty on coals, for the purpose of Metropolitan Improvements, which," &c.

bed of the river, nor any new bridges *on piers* to be erected. The obstruction of a bridge on piers affected the tides a mile and a half down the river. This had been proved by the observations, made and recorded twice every day for 18 years, by the Dock Master of the London Docks. Those observations were given to the Duke of Newcastle (then Lord Lincoln), who accordingly abandoned all notion of encroaching upon the river under the then existing Act of Parliament for the Embankment of the Thames. Money, however, could not be more judiciously expended than in making a good wide quay along the river, by which, amongst other advantages, the passenger traffic from Westminster to the city would be accommodated. So far from the coal-tax being oppressive to the poor, the greatest amount they would pay would be 2s. per ton, and the improvements of the metropolis would be more beneficial to them than to any other class. Mr. Bell then explained (referring to the map) his proposal for a railway station on the site bounded by Little Moorfields, Milton Street, Fore Street, and Chiswell Street, to be reached by adopting and extending the line of the Regent's Canal. This, he observed, would relieve the Holborn line of the traffic from Notting Hill and the North Western suburbs, which at present took that route in preference to the nine miles circuit of the North London Railway, as it would bring it much nearer to the Bank. He then proceeded to explain his proposed adoption of the line of the Regent's Canal to Limehouse, and thence by a tunnel, with a gradient of 1 in 150, under the London Docks, using the Thames Tunnel, and joining the Southern Railways at New Cross. He described the advantages of this plan in relieving London Bridge; and urged the superiority of Fore Street to Farringdon Street, as a City Railway Terminus, in reference to the levels and other circumstances, particularly the narrowness of Newgate Street, and its inadequacy for a large traffic from a Farringdon Street Terminus.

Mr. C. H. Smith, H.M., strongly urged the great importance of improving rather than injuring the river, and advocated the embankment of the stream throughout. At present, whilst the narrowness of the river in some parts gave force and rapidity to the current there, carrying onwards the matters in solution, in the wider parts, as at Hungerford, not only was the mud deposited on the banks, but the stream became so shallow as to be almost useless for purposes of traffic. The Thames being made more available for goods traffic, the streets of London would in consequence be greatly relieved, and if the stream were narrowed it would be practicable at all times to remove, at the quays above bridge, large blocks of stone or other heavy goods, which at present, as he knew from experience, were often detained at the wharfs for two or three days until the tide should be favourable. The largest proportion of the commerce of London went into the London and St. Katherine's Docks, the goods being easily landed, and conveyed thence through the streets by the large goods vans which caused the chief of the present obstructions: this would be prevented if the Thames could be made narrower, and consequently more available for navigation to some distance above the metropolis. Mr. Smith referred to another point of great importance, namely, that in any future Act of Parliament unlimited power should not be placed in the hands of any one individual. This had, however, been done in the case of the Regent Street improvements, and the consequence was that at the junction of Regent Street and Portland Place, there had been a divergence from the straight line originally contemplated.

Mr. Jennings, Fellow, concurred in the importance of a new street from East to West, between Holborn and the Strand, as even more advantageous than the alteration of the level at Holborn Hill. Street improvements should be considered with reference to the heavy traffic, which caused the great obstruction, and in the City it would be most desirable if waggons, instead of waiting in the streets, could discharge and take up goods within the warehouses themselves. This obstruction by vans was exemplified in Gresham Street, or as some termed it *Pickford's* Street, and in St. Swithin's Lane. In

the latter case there was an arrangement between the city authorities and the gentleman whose vans caused the obstruction, that the vans might stand in St. Swithin's Lane with impunity, but that he must be summoned if they stood in Cannon Street. When the latter far less usual event happened, of course the fine was paid. He thought a line from St. Martin's-le-grand to Blackfriars was desirable. It should be borne in mind that streets passing through low neighbourhoods, consisting of small houses, were often as expensive as if taken through better localities, on account of the number of compensations, with the law costs and expenses attending them. The proposed line from London Bridge Station to Charing Cross was perhaps too costly to be likely to pay, but a line might be made from the Bricklayer's Arms to Waterloo Station. He thought the line to Fore Street Station would be a very great convenience, but doubted its financial success, and objected to the line from Limehouse under the river to the South, on the score of the engineering difficulties and the opposition it would encounter from the London Dock Company.

Mr. O. Hansard, Associate, urged the advantage of a street from the Quadrant, taking the line of Leicester Square, and so by a widening of Drury Lane to the Strand at St. Clement's Church. This would relieve the Holborn line, and render Blackfriars Bridge, instead of London Bridge, the leading thoroughfare for traffic going to the South side of the river. He also referred to Gwyn's plans for London improvements, published 100 years ago, in which a bridge next Somerset House, and many of the plans now carried out, were anticipated.

Mr. Cates, Associate, referred to, and explained Mr. Pennethorne's plan for a line from New Coventry Street, by Long Acre, crossing Drury Lane, by Carey Street, the new Record Office, Farringdon Market, over Farringdon Street by a bridge, and terminating at the General Post Office. This would save the expense of altering Holborn Hill. He illustrated, by reference to the same plan, the extreme difficulty of laying out a line in this direction, without interfering with the numerous public institutions which stood in the way of an absolutely straight line.

Mr. Godwin, Fellow, begged to say one word in fairness, to emphasise the importance of the projected extension of the West London Railway. This would give to the Great Western and North Western Railways the important advantage of access to the Pimlico Station, and, if an Act were obtained (for which strong interest was being made), to Charing Cross, the project would join the whole of the lines North of the Thames with those on the South, and remove the absurdity of the present railway system of the metropolis. London was the only town in the United Kingdom in which a person wishing to pass through it, from one railway to another, was compelled either to stop at an hotel, or take a cab from one station to another. The West London Railway had been exposed to the greatest obloquy, yet now no less than five projects had been submitted to Parliament this Session in order to render it available, and three of them had passed the Standing Orders Committee. This should serve as an encouragement to all who conceived a good idea, to submit, even for years, to the scoffs and ridicule of a large majority against them. The West London line, thus extended, *must* one day be a good line. The North Western Railway Company, he believed, had agreed to subscribe £100,000. to the scheme, which would unquestionably materially relieve the traffic of the streets of London.

In consequence of the interest attached to the subject the discussion was adjourned to the next Ordinary General Meeting on the 21st of March.

ON METROPOLITAN IMPROVEMENTS.

A Resumed Discussion at the Royal Institute of British Architects, March 21st, 1859.

Mr. Fowler, Fellow, referred to a plan upon the wall, made by himself, of the Metropolitan Railways formed and projected up to February, 1846, with their respective termini, showing the state of the railway question thirteen years ago. Six railways with their termini were then formed, and twenty-one new lines were projected, within a circle of five miles from St. Paul's, their length being in all more than one hundred miles; 200 acres of land, and 9 to 10,000 houses were required, and the outlay was estimated at £15,000,000. sterling. The plan was an interesting one at that time, and it might not be uninteresting now, as indicating the general principles upon which such projects were founded. The object to which he wished to call attention then was continuity rather than concentration, a principle which he was glad to see had been recognised in the previous discussion. His plan showed that the same idea which had influenced himself was adhered to, and more maturely and cleverly developed on the present occasion.

Mr. Donaldson, H.S.F.C., said that the Institute was much indebted to Mr. Rickman for bringing forward this important topic, and preparing the very elaborate plan before the meeting, which displayed the cobweb plan upon which the city had been laid out; not indeed with the skill and arrangement of a cobweb, for in that a certain regularity was observable, which they would in vain seek for in the plan of the great metropolis. At the last discussion Mr. Haywood had made several broad statements of great value, showing that he entertained no narrow views, but looked at the subject largely and comprehensively; and if the public body, of which he was a most valuable officer, would follow his advice, they could not do anything more honorable to themselves or conducive to the public benefit. He (Mr. Donaldson) had been looking into Vitruvius in search of some principles for laying out a city on which they might rely; Vitruvius, however, appeared to have lost himself in questions as to which way the wind might blow, &c., forgetting that in planning a city such minute details could not be entered into, and that the distribution of the traffic, and the main considerations on which it might depend, should be attended to rather than the aspect, North, South, East or West. Thus, there was the maritime traffic coming from the sea board, and the inland traffic coming from all quarters, and there must be stoppages in the circumference of a city, where the traffic must arrest itself. These points must be considered in the first instance before the mere streets in the interior. And here he would allude to the immense revolution which had taken place in the metropolis since the establishment of railways. Thirty years ago there were no railway stations in London, and the mere question was how they could get from the Docks to the West End, and from the West End, as from Oxford Street and Piccadilly, to the North at the Angel at Islington, to the East at Whitechapel, or to the South at the Elephant and Castle. But now the question assumed a grander aspect. They had the North-Western Railway bringing in all the goods and passenger traffic from the commercial parts of the country, and the Great Northern Railway bringing the traffic from the immediate North to King's Cross. The Angel at Islington was now a point of utter insignificance in connection with the interior of the country and the metropolis. To proceed further along the map, there was the Eastern Counties Railway; South of the river the Kent lines coming to London Bridge, and the South Western going to Southampton, and ultimately perhaps to Exeter, joining with the Cornish and Devonshire lines, and meeting the Great Western Railway which at present came no further into the metropolis than Tyburnia. It was with relation to these lines of railway, and not with reference to the existing streets, that the subject of communication must be considered. In Mr. Rickman's large plan the eye detected

at once the lines which the traffic ought to take. Thus, in going from the Eastern Counties to the Bank the present line obliged the traffic to go South in the first place and then to the West; and in the same way the route from the Great Western to Charing Cross had to pass along Oxford Street, and then at a right angle down Regent Street. Nothing could be worse, and the error was evident from the fact that the traffic from West to East, which ought to be maintained free, was made to subserve a traffic not properly its own, namely that going from North to South. From the Euston Station into town the traffic passed through a number of tortuous streets, there being no direct line either to the South, East, or West. The main mercantile traffic of the country came from these points. It was no longer a mere passenger traffic, for all the goods from the manufacturing towns came there, and instead of being sent to the Docks by vessels from the East, they now came from the North, and so encumbered all the main thoroughfares of the metropolis. It appeared to him therefore that a totally different view should be adopted with regard to all the lines they might take in hand, and that the established thoroughfares should be set aside in considering the question, and new lines of communication promoted. The great improvements in Paris, whether executed for political, military, or any other purposes, greatly subserved the commercial interests of that metropolis. The Emperor had carried out the Rue de Rivoli running East and West, and the Boulevard de Sebastopol going to the North and South, and those two great lines of communication served to disembarrass the streets right and left, and had thereby relieved all the other streets. He (Mr. Donaldson) believed that all our own streets would be wide enough if streets from the railway stations were duly provided. But the question then arose, where were the railway stations to discharge either their goods or passengers? It appeared to him that Charing Cross was one point, and the bridges were others; and this not merely to distribute their traffic over the metropolis, but to afford communication with other railways. At present the accommodation afforded by the bridges was most scanty and most imperfect. Then again there should not only be great lines running North and South, and East and West, but also diagonal lines of communication, *e. g.* a straight line from the Angel to Charing Cross, and another from King's Cross to Waterloo Bridge. Additional Bridges were required between Waterloo and Blackfriars, and Blackfriars and Southwark. The densely populated district of Lambeth had no communication across the river without another bridge; and the railways had no communication with each other. Some millions laid out in producing these improvements, which the state of the metropolis now required, would ultimately prove great economy, and the outlay would repay itself. London was called a great commercial city, and there was no reason why it should not be made not merely a centre of commerce, but likewise one of the most convenient, salubrious and attractive cities in the world. Paris owed much to its attractions in this respect, and a hundred times as many visitors as at present would come to London, if the requisite funds were distributed in a proper way to embellish the metropolis. Taking the matter in a grand point of view, the object was to obtain as immediate, concentric, and straight lines of communication as possible; there would be great economy therefore in diagonal streets, especially in buying up the interests of the parties. In diagonal lines it was chiefly the back parts of premises that were cut through, and therefore less compensation had to be paid than in taking the front lines of house, and in establishing a better rental on the diagonal line much would be done towards repaying the outlay.

Mr. Matthews, Associate, said it was necessary to compare what had been done in this country with what had been done by others. While the population of London had so enormously increased, that of Paris had decreased, since the improvements there had commenced. Political economists had come to the conclusion that the expensive and extravagant—he might say, reckless—outlay for the improvements of Paris had been the means of bringing France, at one time, to the point of ruin. The

cross streets of London were objectionable, Oxford Street, for instance, being a main line from West to East should not have the North and South traffic carried over it, and if that principle could be carried out a great deal of inconvenience would be removed. As for making large and expensive improvements at a cost of seventeen millions, as proposed by the Board of Works at a time when they were going to spend probably five or six millions in diverting the drainage from the Thames, he was confident that, as a practical question, the Government would never sanction the proposition. We ought rather to be happy with our cross streets, crooked streets, and spider-web streets than hamper the country with any expenditure which would tend to weaken its resources.

Mr. JOHN BELL, Visitor, said that it was necessary, in order to realize Mr. Donaldson's plan of a direct communication from one side of the metropolis to the other, that there should be another bridge at some central point. He thought London required to be opened out in the centre. They had not the advantage of being able to carry out any very large schemes, from the many obstacles in the way, but if it were possible to connect Charing Cross with the Surrey side of the river by opening the centre part, forming a great wide space double the size of the Place de la Concorde, it might serve many purposes besides that of beauty. A half-mile clear vista from the National Gallery across the Thames would be very beautiful, and would very much heighten the value of all the property on the Borough side.

Mr. C. H. SMITH, H. M., referred to an article occupying a whole page of the *Times* of the previous Saturday, and involving a gross expenditure of twenty millions. The plan included the widening of Hungerford Suspension Bridge, and forming a new street to West Strand. There was no doubt that a large and commodious bridge at Charing Cross, about the site of Northumberland House, was desirable, but he would not go to the extent of widening Hungerford Bridge. A bridge at that point would relieve the traffic considerably, because at present there was scarcely any from the West to the South which did not go by way of Charing Cross. There was another special plan—that of widening Upper and Lower Thames Street. At present he considered Thames Street an excellent miniature example of what should be carried out along the banks of the Thames. Mr. Smith referred to a diagram,* showing that at London Bridge, where the largest vessels were collected, the river was 946 wide, and he never heard any reason for its not being wide enough. From Westminster Bridge to Blackfriars the width was so much greater that 300 ft. could be taken from it, and the space gained would form a street like Thames Street as an embankment, with wharves and warehouses. The warehouses might extend to the water's edge; the under part serving for loading and unloading vessels, and a street 100 ft. wide would remain on the land side. There was breadth enough to carry out that scheme, which would take the traffic from the docks in the East up to the West-end. The street would be formed on the bed of the river; in fact, *in* the river, because the bed being of hard gravel would afford an excellent foundation. From that street there should be ramifications Northwards, at three places at all events; one from the "River Street," if they chose to name it so, proceeding, as already, into St. Paul's Churchyard, because there was now a crescent round St. Paul's, and the traffic would turn easily to the right and left. That line would pass through the site occupied by Doctor's Commons. A similar crescent was already formed by St. Clement Danes Church, and at that point he would have a second street from the river, on the line of Milford Lane, being a short distance, with property of little value, and affording a direct opening without rendering it necessary

* Width of the Thames at High Water (Walker and Burgess' Measurement in Parliamentary Report)—

Nine Elms, 680 ft.	Vauxhall Bridge, 702 ft.	Penitentiary, 600 ft.
Millbank to Bishop's Walk, 1050 ft.	Board of Control, 1200 ft.	Buckingham Terrace, 1480 ft.
Somerset House, 1250 ft.	Temple, 1240 ft.	Blackfriars Bridge 995 ft.
Queenhithe, 700 ft.	Southwark Bridge, 720 ft.	London Bridge, 946 ft.

for the traffic to turn an angle. Then at the new Charing Cross Bridge there would be another opening, or if there were two there it would be all the better. The embankment and deepening of the Thames from Westminster to London Bridge would not be attended with much expense, and it would do away with the accumulation of mud, and consequently the effluvia which arose from its being exposed on the banks to the sun's rays. The embankment would enable the shipping to go up the river from the Eastern to the Western end of the metropolis, and the offensive matter would be carried off down to the sea. He thought they were in the way of discontinuing the use of sailing vessels altogether, and after generations would perhaps wonder how people ever navigated with such unmanageable things as sails. If his plans were carried out, steamers would be able to pass under all the bridges.

Mr. Fowler, Fellow, said that numerous schemes for the improvement of the metropolis had been based upon the proposed embankment of the Thames. Many years ago he had an opportunity of inspecting Colonel Trench's drawings for that purpose, both on the North and South sides, so as form a fine communication from the West-end to the City. This was altogether a most captivating project. It was submitted to the Prince Regent, backed by strong influence in the Government and the Court, but not in the City, where, as usual, there was a difficulty, in this instance insuperable, on account of the enormous sacrifice of property it would involve; for the mere using the land covered by mud was not the whole of the case for compensation, but the mud banks formed the frontage of a most important property which was worth thousands upon thousands. However desirable it was therefore both for use and ornament (for the two would be combined in the embankment), he was afraid that the enormous compensation which would have to be paid to those having property on the river banks would be a fatal bar to it. In a country like this, expense should not be a bar to any great improvement, but hitherto it had been so, and he was afraid he should not live to see that bar removed. At the time he first became acquainted with London, now many years ago, there was a perfect absence of improvement, and none of the great West-end changes had been commenced. Pall Mall was blocked up at its East end by a number of houses, and Regent Street had only been projected. St. Alban's Place occupied the site opposite to Carlton House. John Nash had the boldness to propose this line, for which he deserved great credit. We were now accustomed to great projects, but they were then very difficult; and unless he had been backed by Royal patronage, and possessed a strong mind, no such improvements could have been carried out. They had witnessed that and other great improvements, and creditable as they had been, and highly advantageous, it was evident that they had not kept pace with the increased importance of the metropolis, and certainly not with the improvements in Paris; but perhaps that arose from the difference in the population, and the constitution of the two governments. No general principles had been laid down in this country, but on the contrary local and individual interests had been allowed to prevail. On reading Mr. Haywood's remarks, he had been glad to see how well that gentleman had dealt with the subject, although the principles he laid down had been too much lost sight of in modern times. The line from the Lyceum to Bloomsbury, by Endell Street, had been formed, not by cutting through old property, but by taking advantage of existing lines, and the advantage of a straight line and a new frontage on both sides of the street had been thrown away. Of course it required a larger amount to purchase a property right through, but then there was the advantage of the frontage. Moorgate Street on the contrary had been extremely well done. The railway system was now so much mixed up with street improvements that all plans proposed must have reference to it. One proposal was a direct communication from Charing Cross across the Thames to London Bridge, which would be an immense convenience to persons coming from the North and West. This was one of the most important things that could be effected,

and he understood it was now in Committee in the House of Commons, but there were misgivings about the amount of money the Company could spare. That, however, was their own affair, and they must all feel obliged to any persons who had the boldness to enter on such a project. The great thing was to avoid the concentration of traffic at too many points. The spider's web was a familiar illustration, but there were necessarily many centres in the same town. General rectangular lines of plan were not suitable to large towns. At all events they were not laying out a town on the Missisippi, where abstract principles might be applied, and therefore they must take London as it is, and do the best they could to modify and alter existing arrangements, according to such means as they had in their power.

Mr. Blake, Fellow, would remark that the docks should not be lost sight of in any arrangements, connected with the railways. Between the docks and the railways, the dock traffic was one of the greatest features.

Mr. Matthews expressed an opinion that the docks would all be removed in the course of ten or twelve years.

Mr. Kerr, Fellow, said, the observations which had been made were mostly practical as matters of detail, but he had as yet heard no fundamental principles stated as to what the metropolitan improvements should be. The question must be decided by natural principles, and by artificial ones based upon them, and there must be certain rules and principles for laying out such a metropolis as this, and it would be very desirable that they should be laid before the public, who could then form some idea of what ought to be done, and where it would be right to begin, and where to stop. It certainly was not easy, but he thought it was possible for Mr. Haywood to write an essay on the subject, and to make the subject plain and indisputable in its principles, showing how London was formed, and where it had wandered from its proper course. Till that had been done the public would not be satisfied with any outlay, and he doubted if the necessary funds would ever be granted. He would suggest that London had begun at a centre, and for many centuries all the roads were formed to concentrate in direct lines in that centre—which was the Bank. These roads, however, had become diverted on account of levels and other various causes; and so the main lines, which were originally highways and were now streets, were found to be curved; and these were cut and crossed by other streets. He thought the lateral system should consist of concentric rings, with diagonal crossings, like the spider's web of which they had heard so much. Originally the City was the nucleus of the metropolis; and then hamlets rose up around it, and the main roads from those hamlets went to the city of London. Then roads were formed from hamlet to hamlet, till the present main lines shown upon the map were produced. That was a natural process. The American system was different. *There* they acted upon an artificial basis, laying out their streets by squares and T squares, than which nothing could be more objectionable. New York was on an island, and consequently the concentric system existed there; but "Fifteenth Avenue," "Twenty-seventh Street" was abominable. Taking the American system at its worth, they ought to lay down some practical principles to be applied to London as it is. It was impossible to throw overboard the consideration of such questions as were sure to be asked in the House of Commons, and it must be remembered that Mr. Haywood's street from the Bank to Hyde Park would cost a million a mile. The subject of new streets was a delicate one. It was of no use to prescribe that a street should be straight and of a certain width. They must take London as they found it, and compromise with it in its present state. The railways had now reduced the subject to a practical form, with regard to the traffic coming from all parts of the country, and he thought the time was arrived when some one in a high position connected with metropolitan improvements should educe the principles upon which the railways should be brought into London. It was most important that railway stations should not abut upon

main lines of traffic, and in this respect the North-Western Station was admirably situated, as the traffic from it became dissipated before getting into the centre of the town. He should be glad if some gentleman could give a scientific view of the subject.

Mr. M. Digby Wyatt, Hon. Sec., could not accept the challenge to give a scientific view of the question, but would endeavour to illustrate it. London in its origin commenced with a walled city, with a centre in the line of *Cheape*, near the present Mansion House. The roads mainly diverged from this centre to all the gates of the city, and so it began to form the spider's web which had been spoken of. Each of these main arteries left interstices which were gradually filled up, till, as the population increased, the city, unable to hold any more, burst out into different lines spreading from the old walls, and the directions they took were to Holborn and St. Giles, Clerkenwell (an early celebrated suburban village), and along the banks of the river to the West. Of course it would be found that at each of the gates, at first built for a limited population, there was always a throttle. So it was where Newgate Street now is, and on the site of Ludgate Hill, where the lines are still so narrow. These defects were felt as early as 1500, and have not yet been remedied. In the earliest map in the possession of the Society of Antiquaries, Middle Row stuck itself out exactly as at present. The same was the case until lately when the authorities interposed, at Blow Bladder Street, and other localities, putting the traffic to a complete check. Anything like an unnatural compression or stricture ought to be removed, and the aneurism was sure to arise so long as there was no continuous motion; but if the stricture were to be removed, of course the traffic would flow on comparatively freely. The great object of removing them was rendered difficult however, from the fact that, in their obstructiveness, they had happened to place themselves in situations where it was not the interest of any individual or of any company to remove them. This was the case with Holywell Street, and with Middle Row. The great difficulty therefore was the want of any association or any body of men, who should be able to say that these obstructions ought to be removed on equitable terms. If any established body could suppress a vested interest by saying it was not worth more than a certain sum, and that it must be done away with, well and good; but if that had to be done by subscription the case was very different. Hence the suppression of a vested interest became a legal impossibility. What was wanted was a legislative body, the City Corporation, a Metropolitan Board, or some municipal body who should have power to examine, without having recourse to the present cumbrous machinery, and also the power of judging, and hearing evidence, before a jury perhaps, so that they might award to each proprietor the proper amount according to the real utility and efficacy of his property, without fighting every individual proprietor, but doing justly, and carrying out that which was for the public interest. He thought that under such a system, in a comparatively few years by a constant attention to these crying defects, they would be removed, and the whole current of working would pass on smoothly. When Evelyn and Sir C. Wren, after the Fire of London, produced their magnificent plans for the restoration of the city, they proposed a grand line of quays. The great scheme of Sir C. Wren was within an ace of being carried out, and it was only by the precipitate action of individuals who had wharf property, and immediately ran up a bill for compensation, that it was stopped. But even in Wren's plan there was, as there always would be, the difficulty that the river began to choke at Blackfriars, and widened at Nine Elms. It might be possible between Westminster and Blackfriars to have such a river side road as had been proposed, but that would only add to existing difficulties, because from Blackfriars to St. Paul's the current would be increased where the veins were not sufficiently capacious to allow it to flow.

Mr. Fowler believed there was some legal right to make a public road along the quays. It had been encroached upon, and although still existing had been lost sight of. There had also been a legal

restriction to building on the forecourts of houses, yet this had been allowed to be carried on to a great extent, particularly in the New Road, from Paddington to the Angel at Islington.

Mr. Haywood, Fellow, said, Mr. Fowler's statement as to the right of way was correct. He must, however, hope that the first money granted for improvements in London would not be spent in embanking the Thames. It would cost two millions and a half. If that was done it would be found that the increased velocity of the river would undermine several of the bridges. Nature had not scooped out the line of the river's banks without an object, and the various reaches in the stream diminished the velocity of the water, and consequently the scouring power. If one thing was better established than another it was that by easing the flow of the water, and having a wide up and down current, the velocity was restrained. The bed of the river had at present been very much lowered; and if the river were reduced to a uniform width there would be so great a velocity and flow that it would bring down one or two of the bridges, or cause great expense to prevent it. He did not mean to say that these considerations should prevent the expenditure for embanking the river, but he would not recommend that improvement to be done first. He might state that he had the traffic of London Bridge taken the other day, and found that, counting both ways, from 19,000 to 20,000 vehicles passed in twenty-four hours. This number would of course be reduced by the opening of Southwark Bridge.

Mr. C. H. Smith, urged the importance of a liberal outlay. The three hundred millions expended on railways were still in the country and had done the greatest benefit to commerce. The same principle should be applied in the case of Metropolitan Improvements.

After passing a vote of thanks to Mr. Rickman for the manner in which he had brought the subject of the discussion before the Institute, the meeting adjourned.

ON THE COMPOSITE VITAL FORMS AND CREATURES OF ART, IN RELATION TO ARCHITECTURE, PAINTING, SCULPTURE AND DECORATION; AND AS SYMBOLS.

By John Bell, Esq. Read at the Royal Institute of British Architects, March 28th, 1859.

Manifold as are the forms of Nature, man, as a poet and an artist, has not been content to exercise his power solely within these limits, but has sought in various directions to reach even beyond, and to evoke creatures of his own thought. In no instance, however, has an animal, thoroughly new and original in all its parts, been produced by him; and it is probably as impossible for him to imagine such as to conceive a fourth primary colour. Creation is not the attribute of the creature, although the field of re-combination is open to him; hence in the various forms observable in Poetry and the Arts, which are without precedent in Nature, we find no new elements, but only new combinations of those already existing. It is evident, that several of these do not adhere to the usual numerical theory of natural anatomical structure. This is a point very readily urged against the use of emblematic compounded forms altogether, especially by those in whom the matter of fact element is stronger than the poetic; but among nations and in times especially imaginative, all such forms were readily welcomed into Art, as were at the same time justly symbolic, poetic, and beautiful.

In a large portion of the vital architecture around us, we perceive four limbs to be the law: *e. g.* in man, in the horse, the dog, the lion, and in birds. In all these the two hind or lower ones are always legs, but of the forward or upper (those nearest the head) the form and use varies. In man they are hands, in the lion and in the horse they are legs, and in birds they are wings. Comparative anatomy still further shows the structural relation existing between these various examples. By setting the skeleton of a quadruped on its hind legs—of a horse, for instance—the relation to that of man is at once seen. Thus, the hock of the horse answers to the heel of the man, the stifle joint to the knee (in both we find a patella), the knee of the horse, with its many small bones, to the wrist, and so on. In a bird, the wing answers to the arm of the man, being similarly attached to the clavicle and scapula; and there are the types of the elbow and the wrist in the wing, which terminates occasionally with an embryo thumb and finger, just as the horse has on each limb only one toe; a member, however, which in the deer, sheep, camel, and lion, and in the foot of the bird, occurs in greater number. There is nothing new in this statement, and I only mention it because it may possibly be brought forward realistically to support the argument, that any composite forms of art based on these higher structures should be confined to this law, to which in some cases they assuredly are not. The Angel, for instance, when represented even with only two wings, has *six* limbs, as also have the Pegasus and the Lion of St. Mark. When, however, we look further among the forms around us, we cannot, I think, hold such limitations to be conclusive, as we see various adaptations and uses of limbs different from and additional to those we are accustomed to in the higher orders, as well as wholly different numerical arrangements and modes of movement. I need only allude to the butterfly and the bee, which have each four wings as well as legs, and to the membrane of the flying squirrel and the bat; which, though not departing from the generally prevalent bony structure, may yet suggest an idea of the means by which the powers of flight might have been added to other modes of movement in the higher animals, had Almighty power so willed it.

It is to the early hieroglyphic mode of writing that we may attribute, in some degree, the introduction of several of the composite creatures of art. Engraved on Egyptian edifices we find records, which may be looked on as midway between writing and art; in which, besides the human form, the lion, the cat, the hawk, and others, we see introduced various combinations of these and

other forms which do not exist on this planet. This, however, was by no means the only cause: apart from their value as emblems and means of expression, the requirements of architecture early found these combined and modified forms exceedingly apt, useful, and harmonious, in presenting contours and masses not to be obtained so well, if at all, by other means. Indeed, as we proceed and consider each in detail, we shall find this strictly architectural use constantly combined with emblematical expression in the best examples of their employment. Like her sister art, Painting also has in all ages found advantage in such combinations. The ancient painters of the best periods displayed their love for them in their most complete state: thus one of the most celebrated pictures of Greek art represented a family of Hippocentaurs. Etruscan art was equally full of these forms, and various pictures found in Herculaneum and Pompeii, give ample proof of the taste for them among the Romans, in the shape of Centaurs, Sphinxes, Griffins, Tritons, Satyrs, and Fawns, but especially of winged human beings, as Auroras, Cupids, and Psyches, in figures of the Winds, and in Genii generally, the profane versions of the Angel; of which, in later times, the works of early Christian art in the Catacombs of Rome, of Cimabue, Giotto, Luca Signorelli, Raffaelle, Paolo Veronese, Titian, the Caracci, Rubens, and others, present us with such beautiful examples, as well as of other composite and emblematic forms of art. Sculpture equally has in all times adopted these forms, and being more abstract in her character than painting, may be considered by some as still more fitted for the representation of these decorative and symbolic combinations; especially as she is constantly employed as a direct accessory to architecture, to complete her lines and masses, and tell her story. In sculpture, therefore, these compound forms, yielding lines, surfaces, and masses, not otherwise attainable, and conveying their special symbolic expression, find a congenial region, while their monochromatic character is calculated to tone down the association of forms not combined in nature; insomuch that those who might not accept a Centaur or a Griffin in an oil picture, might readily permit it in marble or bronze, especially when strictly subserving architectonic purposes. In fact, the justest title to the introduction of these composite forms rests upon their power to symbolize and effect something that cannot be so well effected by other means. This is their true mission, which should be kept in mind while considering them in succession, as it affords a touch-stone to distinguish the really noble and worthy from those which are arbitrary, inconsistent, merely fanciful, and irrelevant.

The Angel or winged human being, in one phase or other, appears to have been a primitive and continuous idea in the mind of man. In all times and places also, these winged human forms appear as symbolic ministers of the Deity — hence the name Angelos, or Messenger. In Egyptian works we find these emblems of intelligence and flight closely associated with the images of the gods. Eternal intelligence itself was indicated by the winged orb, either simply or with the decoration of the double asp, an affix of royalty, "King of Kings." These winged orbs are very prevalent symbols, cut deeply in the stone over the doorways of temples, as emblems of protection and of the object of the buildings, to which they afford architectonic decoration and enhancement.

The Assyrians also used the winged orb or circle as a symbol of the Deity, but always filled by the upper part of a human form, usually occupied with the work of destruction; bending his bow and shooting his arrows. It was natural, perhaps, in the early twilight of the world, that the orb, the most complete and self-contained of forms, should be, like the altar the Athenians raised to the "Unknown God," the emblem of Eternal Deity; and it may probably be allowed that the Egyptian mode of leaving it untenanted, except by the imagination, was by far the most noble. This, however, is a wholly different type from that of the winged human form or Angel, which is represented either as attendant on the Gods, or ministering to their behests; existing in a mid-space, as it were, between them and men. As a symbol, the addition of wings invested an object with

a sort of god-like power, physical, intellectual, or both; thus they were given to evil as well as to good spirits, when it was desired to represent them as possessing great power. In the large Assyrian relievo in the British Museum, showing a contention between a good spirit and an evil one, both have wings; but the minister of good has four while that of evil has but two. As has been well exemplified by Mr. Layard, Mr. Fergusson, and Mr. Bonomi, great analogy existed between Persepolitan and Assyrian art. In the sketches before us the figures have four wings; and in the vision of Ezekiel the cherubim are described as having the same number. These may be but coincidences, yet they appear to point to a certain consistency in the acceptation of the winged human being or Angel in early times.

The graceful winged human figures and genii of Greek, Etruscan, and Roman art, are too well known to require a lengthened notice. Iris, the Angel of the Rainbow, Cupid, the Angel of Love, Psyche, the Angel of the Soul, and Aurora, the Angel of the Morn, were all represented with wings of various kinds, as were also the Angels, or genii of life and death. In Canova's celebrated group of Cupid and Psyche, the aim was, as he himself expressed it, to restore the ancient Gods to their pedestals. On Greek and Etruscan vases we see genii and winged figures, and in a picture from Herculaneum, loves and cupids confined in a cage or basket. Examples of the classic type are to be seen in the works of Thorwaldsen, and in the inimitable designs of our own Flaxman, illustrative of the Theogony and the Works and Days of Hesiod; in which he has so truly caught the purer part of the inspiration of early classic legends and of ancient poetry.

In Holy Writ, we have the highest precedent for the representation of these symbolic forms: the Cherubim were admitted as emblems on the very Mercy Seat of the Holy of Holies. But while the idols of the heathen were objects of worship, the Cherubim were themselves worshipping; and the mode in which they were represented was doubtless in harmony with the architectural and decorative arrangements around. We have no precise data as to the form of these sacred emblems of angelic adoration. In the Bible they are described only in general terms; and Josephus, in his account of the building of the temple of Solomon, says "what the figure of the Cherubim was, it is impossible to express." As we are told that these sacred emblems were actually executed of a precise and definite form, it may, perhaps, be allowable to conjecture something respecting them. I conceive the form of the Angel of early sacred art differed widely from that of any other phase, and I venture to think the passage in Isaiah, 6th Chapter, and 2nd verse, may throw some light on the subject.—"Above stood the Seraphim, each one had six wings: with twain he covered his face, with twain he covered his feet, and with twain he did fly." It is under this image that Milton, so well versed in biblical lore and of so reverential a spirit, describes the Angel Raphael as approaching our first parents in Paradise.

"A Seraph winged, six wings he had to shade
His lineaments divine: the pair that clad
Each shoulder broad came mantling o'er his breast
With regal ornament: the middle part
Girt, like a starry zone, his waist, and round
Skirted his loins and thighs, with shining gold
And colours dipt in Heaven: the third, his feet,
Shadowed from either heel with feathered mail,
Sky tinctured grain. Like Maia's son he stood
And shook his plumes, that heavenly fragrance filled
The circuit wide."

In Ezekiel, angelic beings are mentioned as having four wings, while there is no passage in which the Cherub is introduced in which more than two wings are spoken of, although, indeed, on no occasion is it said that they had only two; but the view I venture to take of the subject, even if it were so, would involve no want of coincidence between the form of the Cherub and Seraph, which I conceive to be the same. Where Ezekiel speaks of four wings, he adds that the wings were joined together. It appears, therefore, probable from these descriptions of six wings, four wings, and two wings, that they could be united in action in one expanse, or divided when required. If this view be worthy of any acceptation, it at once unites the various descriptions of the sacred Angel into one type in form and appearance, only distinguished by office; Cherub signifying fulness of knowledge, and Seraphim the shining ones; and the Cherubim of the mercy-seat are described in Exodus as made of beaten gold, the most shining and radiant material known. My idea of the Angel of sacred art, though differing from that of any other type, is yet, I submit, reasonable as a naturally clothed vital form, either in action or in repose; it displays an amount and disposition of wing that would poise and convey the form in flight with more apparent ease, by far, than only two wings on the shoulders; it offers a magnificent background and enhancement to the human form; and either standing, kneeling, or flying, is capable as a form of art, by the arrangement of the wings in accordance with the description in Isaiah, of presenting a more complete symbol of absorbed and seraph adoration than is to be expressed by any other means. Milton also presents us with some magnificent descriptions of Angels, not only in Raphael and Michael, the archangel, but in the fallen angel, Satan. The painters of the middle ages were more realistic in their representations, gifting their evil spirits no longer with plumage but with the wings of bats, to symbolize that they had fled from light. Raffaelle, Rubens, and various others, have so represented the fallen spirits, and probably, if Michael Angelo's copy of Dante had not, most grievously for the world of art, been lost at sea, we should have on its margin, on which he had made many sketches from the Inferno, many marvellous compositions of this nature.

Among the Angels of modern and Christian art must be reckoned the Æons of the Gnostic heresy in the early ages of the church. These enthusiasts claimed to know more than the rest of the world—hence their name—and at first were highly thought of, but afterwards they fell deservedly into the most evil repute, and eventually died out about the VIIth century. Their Æons were mythical mysterious intelligences, of what character we now hardly know, but of which (although the Gnostics claimed to be Christians) they were informed, they said, not by the gospels but by some other revelation or means. Their gems, I believe, are now their principal records. The one represented was worked in Egypt, and has a very Egyptian character, the arms and wings being associated in the same way as in the winged genii of that country. The representations of the "Emanations" of the Gnostics are of a most debased type, and we cannot receive them as truly belonging to Christian art.

In the early paintings of the Greek church, the Cherubim and Seraphim are frequently represented with a various number of wings, usually very gorgeous in colour—green, red, and blue; generally the Seraphs with red and the Cherubs with blue. Milton, however, gives golden wings to his cherub, Contemplation. Knowledge and love and shining beauty seem the attributes of the superior angels. The Cherub, as it still holds its place on our country tombstones (and when perchance it is well carved I know no better decoration) is merely a child's head with wings, with us generally two, but sometimes four and sometimes six, as was usual in the Greek church. They are symbols of the soul, and of heavenly intelligences, though the representation of the organs merely of thought and flight. In Raffaelle's picture, the Madonna di San Sisto, the whole upper background is made

up of a glorious galaxy of these cherubs represented as children. On various of the keystones of the interior arches of St. Paul's, three of them are grouped together, and the same is the case under the dome of St. Peter's, where they are colossal in reality, though diminished by distance, and they have bodies. A remarkable example is afforded in a beautiful composition of very early Christian art in the Catacombs of Rome (in the very spot in which tradition says that the bodies of St. Peter and St. Paul were buried after their martyrdom), in which two angels are represented as supporting our Lord in an elliptic orb. The original is an exquisite design of unusual form, yet well adapted to the purposes of decoration. The analogous example from York Minster, selected by Flaxman to illustrate his lectures, I conceive to be inferior. In various of the examples illustrating this part of my subject, from early Christian art, Byzantine, Italian, German, and that of our own country, are to be seen arrangements of six wings, according to that which I conceive the sacred type. There are some architectonically good angels in the spandrils of Lincoln Cathedral, and some, if I recollect right, far more delicate and better wrought at Ely. Some painters have occasionally left out the wings altogether, as in the ministers of wrath represented by Raffaelle in his picture of Heliodorus stricken in the Temple. This, however, is an exception, and the angelic being, either as a minister of wrath or of blessings, as the destroying angel over the palaces of the Egyptians, or at the Annunciation, is usually represented with wings. Of the four and six winged examples Byzantine art is full, and in one from the dome of St. Sophia, even more than this number are indicated. Of the two winged, none are perhaps more varied and pleasing than those contained in the examples from the Oratio Dominica of Albert Durer. To the sketches of Raffaelle's ladder of angels in Jacob's Dream, and other compositions by that great painter, whose name, and that of his great contemporary, are both those of angels, I have added examples from the works of our own Flaxman and Blake. The cherubim in the upper lights in St. Michael's, Coventry, and at Cirencester, are represented standing on a white wheel with eight spokes, evidently after the description in Ezekiel. They have six wings of a rich yellow. At Cirencester they hold a book; at Coventry a scroll. According to the Church the divisions of angels are represented with the following attributes:—The Seraph with a sacramental cup; the Cherub with a book; Thrones with a throne; Dominations with a globe and cross: Powers with a sceptre surmounted by a cross; Principalities with a crown of lilies; Archangels as warriors; Angels with various emblems; and Virtues with lilies.

Some painters have, with doubtful taste, made the wings exactly like those of a particular bird; but the more celestial these bringers of tidings, these ministers and messengers of heaven, can be made in appearance, the more the true aim of the artist, I conceive, is obtained.

In exterior architecture there appears to be various situations to which symbolic figures of this kind are expressly suitable as acroteria, or as finials to domed forms, or to separate columns. In high positions seen against the sky, such forms afford with great readiness those vase-like contours so agreeable in such situations; and these either wide or taper, according to the arrangement of the wings. Seated figures with wings, either falling beside them, with their tips crossed in front of the pedestals on which they rest, or otherwise arranged, are capable of producing magnificent broad vase forms. The adaptation of this figure as a finial is, however, by no means confined within these bounds, but with wings outspread or lifted, or in various positions it may subserve those balanced and symmetrical arrangements, which are so suitable in surmounting and culminating forms. In interiors, also, in low relievo with gold or slightly blue grounds (an inexpensive but effective mode of decoration which might be well adopted occasionally), figures of this nature are suitable to occupy various precise forms in architecture. In spandrils and in pendentives, for instance, in which

the feet of the angels coming down to a point, and the wings spread wide over the arches on either side, effect an apt occupation of the space. It is, however, by the sister art of painting, that in these interior situations, and in sacred edifices especially, these angelic forms may be introduced with the most propriety and happiest effect. In St. Paul's, it appears to me that angelic forms might have been well introduced in the dome. So to speak, a dome in a sacred building is itself a symbol, which with its arched form, its horizon all round, and its zenith, may be held to represent a kind of heaven. And by enhancing it with subjects from Holy writ and from art, I conceive that the most beautiful expression of which this form of structure is capable is only to be reached. As the lower portions of the interior, the walls of the nave, aisles, &c., afford spaces for the art representation of those events of sacred history which took place on earth, so would I seek to clothe the dome with more directly heavenly subjects, in which Saints and Angels should float above, and the sacred name of Jah or Jehovah be impressed on the zenith or apex as the culminating symbol of the whole. The treatment, as regards subject, of the interior of the dome of St. Paul's is, I venture to conceive, inferior æsthetically to that of St. Mark's, at Venice, and of St. Sophia, at Constantinople, in which, books and drawings inform me, the space is occupied with heavenly subjects.

Among the composite vital forms of art, the next in dignity, as a symbol, is the Andro-sphinx. "Among fabulous animals," says Sir Gardner Wilkinson, "the most distinguished post must be conceded to the sphinx." "The Egyptian sphinx was usually an emblematic figure representing a king, and may be considered, when with the head of a man and the body of a lion, as the union of intellectual and physical force. Besides the ordinary sphinx there were the crio-sphinx with the head of a ram, and the hieraco-sphinx with the head of a hawk, all which are representations of a king." As regards the architectural use of the Andro-sphinx, of the crio and of the hieraco-sphinxes, which are secondary, they were frequently placed before temples, on either side of the Dromos, or approach to the outer gate. They were usually formed of hard stone, frequently of granite, of great size; and there was an avenue of these architectural features on a colossal scale, extending between Luxor and Karnak, a space of two miles. These, however, were in great measure crio-sphinxes. Sometimes, however, lions were substituted. These arrangements, however, were in all cases closely emblematic, for it is evident that symbolism was so bound up in the character of the Egyptians that no architectural decoration was admitted which had not its significance: in this respect they set a just example, too often since disregarded, even by the Greeks. These forms are considered to have always represented monarchs; hence they are represented male, there being I believe but two occurrences of the true lion-pawed human-headed female sphinx which typify a queen, and these are only in relievo. In relievo also the sphinx is not unfrequently represented with human arms, instead of paws. This, however, is a very inferior and ill-judged union of the human form with that of the lion, and very unartistic compared with the symbol having four leonine limbs. This inferior variety of the Egyptian Andro-sphinx seems to have been held by the Egyptians themselves as very secondary in dignity, as it occurs, I believe, only in relievo of small size, and never in the round as a colossal statue. The larger colossal sphinxes, as the great one on the Plain of Gizeh, near the pyramids, had all four paws of the *same* animal, as we feel at once is necessary for a just idea of harmony and movement; for in no creations of art is a certain propriety more requisite than in these her composite productions. The Colossus just mentioned is an Andro-leonine sphinx, "couchant" as usual; a vast and solid mass, partly carved out of the hard limestone rock, and partly built. Although it is nearly certain that is was the representation of a monarch (Thothmes iv. it is said), we cannot help accepting it in our imagination as an apt image of the tutelar deity of that old land of Egypt, so solemn, so

weird, so mysterious, and now so ruined. It is a remarkable fact that one of the oldest, and certainly by far the largest statue in the world, should not be that of a human being, but of a composite vital form; an evident proof of the vast power of expression that was accorded to symbols of this character in the simpler and earlier stages of the world. Of the three principal varieties of the Egyptian sphinx none are winged; male, leonine, and apteral being the true type of the large dignified statues *in the round* of the Egyptian standard form. Probably we may look upon the Andro-sphinx as affording, even in its want of wings, a truer image of a people whose genius was almost wholly addressed to developing their own powers, riches, and civilization within the valley of their own great river. To borrow a phrase from natural history, the sphinx in Egypt was, as a symbol of dignity and power, ever in its *larva* state, and did not attain its full development into its *imago*, or perfect condition, until it shot forth its wings in other lands; and it may be held that it was then, and then only, that it fully symbolized all those attributes that represent power on this earth, of which wide-spread influence and swiftness of transit and communication form so large a part. There needs no legend under a winged, leonine, Andro-sphinx to indicate its just significance; and I conceive that in the old land of all, before writing was known, the sphinx was a recognized symbol of intellectual and physical power.

It may be conceded, therefore, that the Assyrians did not derive their Andro-sphinx from the Egyptians, nor the Egyptians any winged examples from the Assyrians, and neither from the Chaldees; but from some still earlier common type which was at first hieroglyphic, synchronous with that of the Angel when Art was called on to express by symbol what there were yet no letters to record. It has been even fancied by some that the Cherubim of Holy Writ formed a phase of the Andro-sphinx; an idea I suppose chiefly grounded on the tetraform description in Ezekiel, which speaks, however, solely of visages and appearances, and nowhere of the body of a lion or a bull.

In viewing all these emblematic forms, it is of the first importance to keep their symbolical expressions as distinct as they were in the early time when they were first evoked. The Angel was always the immediate attendant on Divine power, as well as its minister to man, and was thus the only symbol suitable to the Holy of Holies; while the Andro-sphinx was the symbol of human intellectual and physical force. But we will now return to the phase under which it appeared among the emblems, and associated with the architecture of the Assyrians.

In Egypt we have seen that the Andro-sphinx is the type of the king. It never appears to have been so in Assyria, where, at least in the remains hitherto discovered, the king always appears in a human form. Mr. Layard describes the leonine and taurine sphinxes of Nineveh, guarding the portals of the temples, as intended to convey the idea of the union of the greatest intellectual and physical powers. "The sphinx," he proceeds, "as an architectural ornament occupies nearly the same position in Assyria as in Egypt, being placed at the entrance to temples and palaces." It will be noticed, however, that in Egypt these figures are separate, and never even caryatid, while in Assyria they are even yet more closely connected with the structure, partaking in degree of the character of supporting figures in the round, and partly in relievo on two fronts. Their usual posture differs from the Egyptian examples. In Egypt they are always crouched, having the character of repose; in Assyria they are generally erect, and ready for assault and action; being thus typical of the genius of the two nations. The Egyptian are all leonine; the Assyrian are both leonine and taurine. These arrangements appear to have been also common to the Persians. Both these combinations were of course emblems of strength, but probably with some difference of signification. The leonine is of course the superior emblem of power, as it retains the paw, while the taurine is bereft of the horns. The leonine Andro-sphinx with wings therefore holds its place against all comers, and the combined

Egyptian-Assyrian sphinx affords all the elements of the finest type, for conception and dignity, of this symbolic expression of earthly power.

We have seen that in Egypt statues of these symbols were, almost without exception, leonine and male; that in Assyria they were both leonine and taurine, but, according to our present data, always male. In Greece and Etruria, on the other hand, the sphinx was usually canine and female, being represented with the face and bosom of a maiden, the body of a dog, the wings of a bird, and sometimes the tail of a serpent; so that the dignity of the type was at once lost. The paws, however, are occasionally enhanced in a leonine fashion. Egypt kept close her symbolism, or misrepresented it to strangers, and Nineveh had fallen into dust one hundred and fifty years before Ictinus and Phidias commenced the Parthenon. In passing therefore from these old lands to that of Greece, the sphinx lost both among artists and poets its just significance, and from a true type of expression and a just artistic hieroglyphic, became only a graceful classic monster. We have therefore no longer before us the type we considered on the banks of the Nile and of the Euphrates. The sculpture of Ægina, so far as the remains evidence, was of archaic character; and of this class were probably the Andro or crio-sphinxes on the pediment of the temple of Jupiter Panhellenius. In the celebrated chryselephantine statue of Jupiter at Elis, Phidias introduced into the sculpture of the throne sphinxes as emblems of divine wrath, devouring men. On the helmet of the Minerva of the Parthenon, according to the authority at Vienna, an Andro-sphinx was represented on the centre portion of the crest. In the coins of Chios the sphinx is a common emblem, and also on Corinthian pottery. In the Barrow of Achilles, at Troas, a remarkable bronze was found, which is figured in Flaxman's Lectures, in which four winged sphinxes are grouped round the head of the goddess of Wisdom, either as consulting with her, or as immediate messengers of her behests,—one of the few examples of Egean art in which any trace of the old significance of the emblem is retained. This, however, is an early example. The siege of Troy was 1183 B.C. and the character of the work is quite archaic. The most usual application of the sphinx in Greek art is as the minister of divine wrath; thus she is exhibited in the little terra cotta of the early part of the fifth century B.C., in the British Museum, in which a pair are represented as bearing away youths. One of the most graceful forms of the sphinx of Egean art that has come down to us is also in the British Museum, among the Lycian remains, where there is a pair in relievo, which decorated the gable end of a tomb. Still, however, it must be allowed that these also are in some respects archaic, and by no means equal to Athenian art of the best period; indeed it is much to be regretted that we have now no example from the hand of Phidias, who no doubt combined this figure in his usual grand manner. Under some phase or other, it is evident that the use of the sphinx as a feature of art and architecture was very wide. Even in his notice of a palace of the Scythians on the banks of the Borysthenes, Herodotus speaks of the decoration with marble sphinxes. In Greek, Etruscan and Roman art generally, but especially in pottery, these figures frequently occur, and from their highly decorative quality seem to have been in nearly universal use. Winkelman prefixes the figure to the three first chapters of his well-known "History of Art" as an indication of the extreme antiquity he attached to the symbol. Canina, in his restorations of some of the ancient monuments of Italy, introduces many statues of sphinxes. With respect to the modern use of the sphinx, though there are various beautiful examples in decoration, yet as the debased and merely ornamental acceptation and type have been almost universally followed, I do not see that much advantage would arise from dwelling on the subject.

We have seen that the sphinx was extensively used by the Egyptians in ranges on either side of avenues, but never as a caryatid, or immediately attached to their edifices. Now, although there is always some objection to caryatid figures, even in the Erectheum and the temple of the Giants at

Agrigentum, I conceive this only to hold good when the figures are worked out and made in some degree separate. If they are only in relief, *i. e.* not so much figures as emblems of figures, and the block on which they are carved is still left in its integrity of mass, and with its stedfast character undiminished, then it would appear legitimate that the front surfaces, and in some degree the profile of these masses, might be appropriately wrought into large sculptural forms of supportive and dignified character. This, though not done by the Egyptians, was by the Assyrians, and, as far as their archaic art went, it was worked out without fear or trembling. There is no doubt that this latter people in adopting or preserving wings in addition to the other elements of this form had, in the grand and dignified sweeps thus obtained, a great advantage over the Egyptians. Uniting also with the side of the figure, these wings are capable of affording a broad mass and surface of unity, of great service in the enhancement of structural forms, and this in a manner and a degree of which no other composition of form is equally capable. By placing his erect colossal sphinxes thus block-hewn back to back, and stretching out their wings behind them, the Assyrian architect obtained, either with or without the intervention of a narrow upright form of masonry, (containing usually an erect human figure also in relief,) an arch form of much decision and of the utmost force of service; and, indeed on the bold and wide spreading arch-forms thus stamped on the lower tier of the façades of his structures, much of the character and impression of his palaces and temples appear to rest. In doing justice, however, to this type of architecture, it is requisite to separate the real germ of its invention from the archaic crudities and shortcomings of its execution, and to recollect that the works at Nineveh preceded by some centuries the prevalence of the best art in Greece. It appears to me the germ of Assyrian art has such a character of grandeur, that had the Greeks occasionally adopted the style of base, and the application in block cut relievi of the winged Andro-sphinx, a great art success would in all probability have been achieved. The Greeks, however, did not adopt this style of structure, nor the winged Andro-sphinx in its just dignity. In Egypt we have seen this symbol to be one of royalty, and of respect to the gods; in Assyria, though not of royalty, to be yet of great dignity and intelligence. These two phases, evidently from their diverse treatment, not borrowed from each other, had probably a common origin in the art expression of some still earlier race, of which both the Egyptians and Assyrians retained the traditions and emblems. I venture to conceive the two emblems which we are considering this evening to be, if not indeed the *very oldest*, yet *among* the very oldest art expressions in the world—the Angel as the emblem of Ministering and Divine protecting power; and the Sphinx, of Earthly power and intellect. Returning to the winged leonine Andro-sphinx, I conceive its meaning, cleared from fables, not only unmistakeable, but that it has a just claim, in the universal alphabet of art, to be considered one of its simplest, clearest, and grandest hieroglyphics. As Professor Westmacott has well observed, the relievi of Nineveh are still easy to be read by all, while the writing that accompanies them is hard indeed to be deciphered. In conclusion, I would venture to suggest as an application to modern times, that as Britain has her lion, and America her eagle, and as both nations possess great power, intellectual and physical, and wide-spread influence rapidly disseminated—the leonine, eagle winged Andro-sphinx, shown in the model before us, might form a not inapt heraldic symbol of the Anglo-Saxon race.

Mr. M. Digby Wyatt, H.S., was anxious that Mr. Bell, having treated the ancient part of the subject, should next take up the other portions, including the Scandinavian, and other Northern ones, with the Mediæval class of forms as shewn in illuminated manuscripts and carvings, in which moral as well as immoral propensities were set forth under animal types. The whole field of arabesque art moreover was teeming with these composite forms, many exceedingly graceful, which, from the earliest period of decoration down to the present time, had been invariably and continually maintained.

Mr. A. H. Layard, H.M., said that, with regard to the drawings by Mr. Bell representing the Cherubim, it was often found that the artist was led to adopt a type of art which did not exist when the objects themselves were executed. In like manner the shield of Achilles had often been restored, as if the supposed original had been made in the best times of Greek art, and not some centuries before. Authorities of some weight would lead us to believe that the Cherubim resembled the winged mythical figures discovered in Assyria. With regard to Jewish art, scarcely a trace of it remained. All we had to guide us were the sacred books and the traditions of Josephus. There was reason to believe that the Jews were deficient in imaginative art. Their institutions prevented the imitation of the human figure almost entirely. So far as he was aware, they had but small mechanical skill; and he did not know that a single case of Jewish antiquity was preserved to this day. The tombs of the kings and the tomb of Absalom at Jerusalem were all of a much more recent period, probably Roman. In the vision of Ezekiel, the four figures were the bull and the lion, the human being, and the eagle; the same forms that were combined in the mythical figures of the Assyrians. The Assyrians were a Semitic people. Their language was closely allied to that of the Jews, who readily had recourse to the Semitic nations, but never had any sympathy with the Egyptians. The Jews borrowed, he believed, whatever they had of architecture and decoration, entirely from the Assyrians. He was not certain that the Assyrian and the Egyptian symbols of the winged globe were the same. He quite agreed with Mr. Bell as to the advisability of employing composite forms in decoration, especially in the interior of domes, where they would be far more appropriate than representations of the acts of human beings. He might call attention to a very remarkable dome at Saronno, in Northern Italy, the interior of which was covered by painted representations of angels playing on instruments, in every variety of colour, so as to realize the expression of Dante, "that it was like a full blown rose." He had his doubts as to the fitness of introducing the Assyrian sphinx into English architecture. He agreed with Mr. Bell that if the Greeks had taken up the form of the sphinx with their pantheism they might have produced grand results, but he doubted whether races who had no positive credence in the symbol would. The Egyptians looked upon it as a type of their divinity, calculated to awe the multitude, and even in these days the Assyrian colossal figures produced that effect on his own mind when he saw them dug out of the earth. In the Assyrian Court represented at the Crystal Palace, the lower part was accurate, because it consisted merely of casts from the originals, but he did not quite agree in the colouring, which he thought had been rather overdone, and gave a wrong impression; because colour on plaster was very different from colour on alabaster, and it was impossible to know what colours the Assyrians used. In fact, the colour employed in the restoration gave a heaviness, thickness and ponderosity, which he did not think the originals ever had. It would be very satisfactory if Mr. Bell could give any information as to the anatomical principles upon which these composite figures should be formed.

Mr. Bell said, that his theory was not complete, and that he was not prepared to enter into that branch of the subject, but that it would have his best attention.

Mr. M. Digby Wyatt, in moving a vote of thanks to Mr. Bell, made some further observations on the difference observable in works of sculpture representing animals executed in a symbolic and in a realistic manner. In modern times French artists had been most successful in representing animals. Animal sculpture was quite a new field for English artists, and the first thing was to learn to express the animal well and correctly, and then to apply it properly to architectural composition.

The vote of thanks having been acknowledged by Mr. Bell, the meeting adjourned.

SOME ACCOUNT OF THE LIFE AND WORKS OF BALDASSARE PERUZZI.

By Samuel Angell, Fellow. Read at the Royal Institute of British Architects, April 4th, 1859.

In the notice of the life of Le Tarouilly, prefixed to "Les Edifices de Rome Moderne" (the noble work of that indefatigable architect and author), it is remarked that although he possessed a just admiration for the works of Bramante, Sangallo and Vignola, the artist he preferred was Baldassare Peruzzi; and so great was the admiration of Le Tarouilly for this "artista valente" (as he is styled by Milizia) that he compares him to Raffaelle from the resemblance he found in their characters, and in the nature of their talents!

The preference evinced by such excellent authority, and by one so eminently qualified from the direction of his labours and studies to form a correct judgment, has induced me to bring to your notice the works of Peruzzi, feeling assured that there are still among you some who have not been entirely led away from their early studies of Italian architecture, and that even from the Medieval benches (crowded, and so honourably occupied as they are upon this evening of their triumph) I might possibly enlist some sympathy, if not admiration, for so distinguished an architect of the Renaissance period as Baldassare Peruzzi.

Peruzzi was born early in the year 1481 at Accajano, near Siena, and he was sometimes called "Baldassare da Siena," but Vasari states, that both Florence and Volterra (as well as Siena) put in their respective claims for the honour of his birth-place. I believe, however, that we shall not be in error in considering him a Sanese.

His early days appear to have been passed in the workshops of the goldsmiths and jewellers, after which he commenced the study of painting, copying and imitating the works of the best masters, as well as drawing from nature; and upon the death of his father, about this period, his exertions and progress were such, that he was enabled to support himself by his art, and to aid both his mother and sister. We may remark that it is probable his early studies as a painter (more particularly those of a decorative character) produced in him afterwards that freedom and facility in his architectural designs for interior ornamentation, of which he has given us such exquisite specimens in the Massimi Palaces, and other of his works.

I regret that I have not sufficient data to place before you the works of Peruzzi in chronological order. I will adopt, therefore, the arrangement in which they are classed by Vasari, who informs us that Baldassare's first work (after some few unimportant ones at Siena) was a small chapel, near the Florentine gate at Volterra, where he painted certain figures with "infinite grace," after which he proceeded to Rome with his friend and brother artist, Pietro da Volterra. Peruzzi's early days at Rome appear to have been devoted to his studies as a painter, and he obtained great praise for the excellent manner in which he executed in fresco the Chapel of the Great Altar in the church of San Onofrio. He was next engaged in painting two small chapels in the church of San Rocco a Ripa, and having now attained some eminence, he was invited to Ostia, where he executed some beautiful historical representations in chiaroscuro, in the apartments of the tower of the fortress. Many of these represented combats, in which were introduced ancient armour and equipments of war. These decorative paintings are considered among the best of Peruzzi's works in that style, though it is but fair to state that he was assisted in them by Cesare, of Milan.

Upon the completion of his labours at Ostia, our artist returned to Rome, where he formed an intimate friendship with his celebrated brother Sanese, Agostino Chigi (the rich banker and amphitrion of his day), and with his assistance he was enabled to remain in Rome for some time, prosecuting

his studies (more particularly those relating to architecture) with distinguished success, so much so, indeed, that he secured the patronage of Julius II, the Cardinal Raffaelle Riario, Bishop of Ostia, and of Messer Ulisse da Fano, for each of whom he executed painted decorations; but his chief architectural work at this time was the celebrated "Farnesina Palace," for Agostino Chigi, on the Lungara. Le Tarouilly gives 1510 as the date of this admirable production, (so well known I have no doubt to most of my audience), a work to which Vasari applied the happy expression of "Non murato, ma veramente nato."

Situated as the building is upon the spot formerly occupied by the gardens of the Emperor Geta, Baldassare composed his plan upon the most simple arrangement, evidently considering it as devoted to pleasure and entertainment, rather than for a domestic residence.

Le Tarouilly's three plates convey an admirable description of the edifice, with the sole exception that one of its most attractive features, (the exquisite colouring of the ornamentation), is not rendered; this omission, however, is in a great measure supplied by the beautiful coloured plate in M. Gruner's noble volume, and in the Italian prints tinted in body colour.

The Farnesina owes much of its celebrity to the beautiful pictorial embellishments of those eminent masters, Raffaelle, Giulio Romano, Sebastiano del Piombo, Daniele da Volterra, and Annibale Caracci, and, with all his fond preference for Peruzzi, Le Tarouilly allows that many parts of the exterior architecture are open to criticism; the design however is full of grace and elegance, and the ornamentation is deserving of all praise. Great portion of the enrichments in "terretta" are by Peruzzi's own hand, and the great Titian himself is said to have been deceived by the marvellous imitations of relievos.*

Peruzzi was next employed, according to Vasari, in executing a façade in "terretta" between the Campo de' Fiori and the Piazza Giudea. It is described as an admirable performance, particularly the perspective views which were introduced in it. This work was a commission from one of the Pope's chamberlains.

In the Chiesa della Pace our artist painted a chapel for Messer Fernando Ponzetti (who was afterwards made a cardinal); he also painted in "fresco," in the same church, a picture for Messer Filippo da Siena, representing the Virgin ascending the steps of the temple; this picture contained a great variety of buildings, with many beautiful ornaments of various kinds.†

A palace in the Piazza de' Satiri, at Rome, has been ascribed to Peruzzi, but although the plan has sufficient merit to be worthy of this great master, the authorship does not appear so firmly established as to warrant a longer notice of it.

The Palazzo Costa in the Borgo Novo (built for Jacobus Brixianus, surgeon to Leo X.) is not far distant from St. Peter's. Some attribute the architecture of it to Raffaelle, but Le Tarouilly (the best authority upon such points) is inclined to ascribe it to Peruzzi. The design is of unpretending character, and the ground floor (as in many instances in the Italian palaces) is occupied by shops. Much study has been given to this design, particularly to the rustication, and it is upon the whole well deserving the attention of the student.

The author of "Les Edifices de Rome Moderne" has devoted three plates to the Palazzo Linotte, in the Vicolo dell' Aquila. This palace is situated near the Cancelleria (the great work of Bramante),

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* It was in this palace that Agostino Chigi gave the celebrated entertainment to Leo X, when he ordered all the silver plate as it was removed from the tables to be thrown into the Tiber. We may apply the old Italian saying here, "Se non è vero è ben trovato."

† Annibale Caracci copied this work: the drawing he made was in the late Duke of Devonshire's collection.

but little is known of its date or history, and it is attributed to Peruzzi more from its style than from any authentic source. It has been ascribed also to Bramante, and to Michael Angelo, but there are no traces of the distinctive styles of those architects, and if not the work of Peruzzi, the claims of San Gallo I believe would be considered as most worthy.

The Palazzo Ossoli, in the Via de' Balestraji, is attributed to, rather than positively known to be the work of Baldassare. The simple and masterly arrangement of the plan, and the elegance of the façade partake of the master mind and hand of Peruzzi, and I think there can be no doubt that Le Tarouilly is correct in naming him as the architect.

The Chigi Chapel in the Church of Santa Maria del Popolo, has been generally attributed (both as to its architecture and pictorial embellishments) to Raffaelle; but we owe it to the study and research of Le Tarouilly, supported by the opinion of his countryman, Lalande, that the architecture is from the hand of Baldassare; the style and imprint are his, and the "Corinthian Order," as published by his pupil, Serlio, resembles in a great degree the one that has here been employed. Peruzzi's intimate friendship with Agostino Chigi may be fairly adduced as an additional reason for believing that he was employed in this chapel as architect, while Raffaelle (as in the Farnesina) was commissioned with the pictorial embellishments. This chapel is certainly a "Capo d'Opera!" and although I may be venturing upon tender ground this evening, in daring to uphold the Italian architecture of the XVIth Century for ecclesiastical purposes, I am bold enough to admire this fine specimen of the taste and genius of Peruzzi, enriched by the master hand of the divine Raffaelle, and to join in the enthusiastic language of Le Tarouilly, "Honour then to Chigi, to whom we owe this chef d'œuvre, and who has immortalized himself by joining his name to those of the two great artists, to whom he was the Mecænas!"

Peruzzi's fame was now so well established as a painter, that he was appointed one of six eminent artists to paint a picture in honour of the arrival in Rome of Giuliano de' Medici, when he was made commander by the Holy Church: he selected as his subject "The Betrayal of the Romans by Julia Tarpeia;" and this picture is said to have borne away the palm. Vasari also mentions that he was employed upon painting the façades of a house near the Piazza Altieri, for Francesco Buzio, on which the portraits of all the Cardinals were introduced in the frieze. Baldassare, however, did not confine himself to strictly architectural subjects, for we find him engaged in painting an extremely beautiful bier, for the removal of the dead to the place of their burial, for the brotherhood of Santa Caterina, of Siena.

About this period (1520) Peruzzi appears to have been invited to Bologna, to enter into the famous competition for the designs for the façade of the Church of San Petronio; an event which appears to have excited as much interest in those days, as the struggle for the Government Offices or the Spurgeon Tabernacle in our own times. We learn that Peruzzi sent in two designs, the one Italian, and the other Gothic; they are still preserved in the sacristy of the church, and Vasari is loud in his praises of a perspective view: this, I presume, applied to the Italian design, for I suspect Baldassare was more at home with the five orders than he was with the pointed arch, and buttress, and pinnacle of the Medievalists. While at Bologna, Peruzzi designed the portal of the Church of San Michele, in Bosco, and embellished the Monastery of the Monks, di Monte Oliveto, in the environs of Bologna.

The Cathedral at Carpi was also designed by Peruzzi at this period. For the Count Battista Bentivogli he made a design in chiaroscuro, "The Nativity of Christ and the Adoration of the Magi." As this drawing is now in our own National Collection, we ought to be enabled to judge whether its merits deserve the encomiums Vasari has bestowed upon it, but unfortunately it is

placed in so dark a position on the staircase as to be quite invisible to the eye of criticism. The catalogue, however, throws some little light upon its history, for we learn from it that the drawing was made in 1521, and was engraved on wood by Agostino Caracci in 1579. The three Magi are portraits of Titian, Raffaelle, and Michael Angelo.

While commencing the Church of San Nicolo, at Carpi, our "painter architect" was called upon to enter a new sphere of action, and to bring to bear his engineering knowledge, in planning and superintending the fortifications for the defence of his native city, Siena. Upon the completion of these works, Peruzzi again repaired to Rome, where, upon the death of Raffaelle in 1520, Leo X. appointed him architect to St. Peter's, when he was called upon to design a new model, upon which it is said he employed so much talent and skill, that even the fastidious Milizia considered it worthy of praise. Serlio (who was Baldassare's pupil) describes the plan to have been a Greek cross, terminated at each extremity by a semi-circular apse. There were four square sacristies, over which campanili could be erected. At each extremity of the cross was a semi-circular porch, through which, by three openings composed with four detached columns, was an entrance to the building. The great altar was in the centre, surrounded by four large piers, supporting a cupola 138 feet in diameter (within one foot of that since executed). Each of the four naves had two side aisles, with cupolas at their intersections 48 feet in diameter.*

The tomb of Adrian VIth. in the Chiesa dell' Anima, is the work of Peruzzi; and the Vigna of Papa Giulio, on the Flaminian way, although ascribed to Sansovino by Vasari, is considered by Le Tarouilly, as the work of Baldassare. It is a most charming and elegant composition, and we are at a loss which to admire the most, the grace and simplicity of the whole, or the exquisite delicacy of the detail.

Peruzzi's genius appears to have been nearly universal, for we next find him engaged painting two scenes, for the representation of the "Calandra," a drama written by the Cardinal Bibiena,† and performed before the Pope: these scenes are said to have served as models for whatever has been since done of that kind. The preparations for the coronation of Clement VIIIth were also entrusted to the care of Peruzzi in 1524.

The Court Yard of the Palazzo Altemps, in the Piazza Fiammetta, at Rome, is attributed to Peruzzi, by Le Tarouilly: there are many parts of the details and ornamentation which certainly appear to be from his hand, while at the same time there are other portions of the design (for instance, the attic and the arrangement of the windows on the side of the cortile) which do not render me over anxious to claim this work for our "artista valente."

A small palace in the via Giulia, at Rome, is also given to us by the indefatigable author of "Les Edifices de Rome Moderne," as the work of Peruzzi, and it presents an excellent specimen of the great extent to which external ornamentation was formerly carried. The decorations are described to have been in some instances in "fresco," and in others, painted in imitation of bronze and gilt, and portions are said to have been executed by Baldassare's own hand: they are composed in a grand style, and after the manner of the antique. The fresco figures were still tolerably preserved in 1823, but since that period the palace has been used as infantry barracks, and I regret to say that the inmates have proved themselves no great admirers of the Fine

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* Peruzzi's salary as architect to St. Peter's was only 250 scudi per annum: no wonder that with so inadequate a remuneration he died in poverty.

† The accomplished Historian of Leo Xth says "that Bibiena gave sufficient proofs of his literary studies in his celebrated comedy of the 'Calandra,' which, although not as some have asserted, the earliest comedy which modern times have produced, deservedly obtained great reputation for its author."

Arts; for poor Peruzzi's ancient warriors have been most scurvily treated by their degenerate descendants. A portion of arabesque from the ceiling of the staircase has been preserved and is shown by this enlarged copy from Le Tarouilly's sketch. The doorway under the vestibule of this palace is made to diminish in width upwards; the same method has been adopted by San Gallo, at the Palazzo Farnese, and upon this Le Tarouilly remarks, "that at this epoch (the XVIth century), when there was a general feeling for the antique, and when the cultivation of ancient art had become as it were the true religion among all the professors; when learned commissions were instituted to make commentaries upon Vitruvius, it is not to be wondered at, that the two eminent architects, Peruzzi and San Gallo, studying together the ancient monuments, should about the same time have made the same application, from what they had studied."

With the exception of Peruzzi's last great work at Rome, his crowning effort, the Palazzo Massimi, I believe I have gone through (but in a very slight and imperfect manner) his principal works in the Eternal City; and I have now to refer to the misfortunes which overtook poor Baldassare, at the time of the lamentable sack and plunder of Rome by the Constable de Bourbon, under the banners of Charles V.*

The unfortunate Peruzzi was taken prisoner by the Imperial soldiers, lost everything he possessed, and was grievously maltreated; for it so chanced, says Vasari, "that Baldassare, being a man of noble, grave, and commanding aspect,† was believed by them to be some great prelate or other man of high rank in disguise, and one who could pay an enormous ransom; finally, however, those most impious barbarians discovered that he was a painter, and one of them who was a devoted adherent to the Constable de Bourbon, compelled our artist to take the portrait of that "Sceleratissimo Capitano" (as the indignant Vasari styles him), the enemy of God, and all good men, either by showing him his corpse, or by some other means, perhaps by giving him sketches of the face, or describing it in words enough; they compelled him to make the portrait.‡

Poor Baldassare at last made his escape from Rome, covered with wounds, but misfortune was still in his train, for upon making his way to Porto Ercole, and from thence to Siena, he was attacked and stripped on the road, and at length arrived at his native city in a most pitiable condition, having heen deprived of everything but his shirt§ (fortunately for our poor sufferer it was during the summer months that this calamity happened to him). It may readily be supposed that he met with the kindest reception from his friends and relatives in Siena, and it was not long before he entered the service of the Republic of that state, and was appointed superintendent of all the works connected with the fortifications of the city.

About this period Peruzzi executed the beautiful altar, and the Chapel of St. John the Baptist, in the Cathedral of Siena. The villa Belcarro, near that city, and the fine portal of the Sacrati Palace, at Ferrara, were also designed by him at this date, and it was probably about this time that

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* Bourbon, without any artillery, arrived quite unexpectedly at Rome, on the night of the 5th May, 1527, with 40,000 men; the assault took place the following morning.

† The portrait I present to your notice is, I submit, in accordance with Vasari's description. It has been enlarged from the frontispiece to the works upon the Massimi Palaces by Suys and Haudebort, by my friend, Mr. Charles Kelsey, the excellent Sculptor of several of the enrichments at St George's Hall, Liverpool.

‡ It was this same Constable de Bourbon that the braggadocio Cellini takes credit to himself for having killed by a shot from his arquebuse. All historians agree that Bourbon fell by a musket shot, early in the assault, while distinguished by his white mantle, with a scaling ladder in his hand, leading his troops to the walls; and, although Benvenuto was a great boaster, I know no reason for depriving him of the honour of killing the "Constable."

§ Milizia says he arrived at Siena "nudo come nacque."

he painted his celebrated picture for the Church of Fonte Giusta, at Siena, representing "the Sibyl announcing to Augustus the birth of Christ," which is said to be his masterpiece. So highly was this picture esteemed by Lanzi, that he says, "the painter gave it so divine an enthusiasm, that Raffaelle, treating the same subject, as well as Guido and Guercino (whose Sybils are so often met with) probably never surpassed it." Forsyth describes this picture in the following terms;—"Peruzzi's Sibyl at Fonte Giusta is a sublime figure, but, perhaps, too sedate for the act of prophecy."

Peruzzi was once more called upon to exercise his services and talents upon military engineering, for the Imperial and Papal armies having advanced to the siege of Florence, His Holiness ordered Baldassare to the camp, there to give his aid and counsels for the conducting of the siege; he appears, however, to have entered upon this employment with great reluctance, as it was against the wishes of his fellow countrymen, the Senese, who were good Ghibellines, and whose sympathies were all with the Florentines. In a note, however, by Mrs. Foster, in her admirable translation of "Vasari," she states, from a letter by Baldassare himself, as cited by Gaye (Carteggio inedito), that he really did serve against Florence, and that he adverted to the possibility of attacking the city from the Poggio Imperiale. At all events, his conduct in this affair was greatly displeasing to the Pope, and upon the termination of the war, Peruzzi, being desirous of returning to Rome, was obliged to avail himself of the good services of the Cardinals Salviati, Trivulze, and Cesarino, to obtain His Holiness' permission, and through their kind offices he was reinstated in such appointments as he previously held.

Upon his return to Rome, Peruzzi commenced the designs of two beautiful palaces for the Orsini family, which were erected on the road to Viterbo, and he designed some buildings to be constructed in Apuglia. Our artist found time to study mathematics and astrology (in which it is said he took great delight). He also commenced a work on the antiquities of Rome, with a Commentary on Vitruvius, and prepared drawings in illustration of the same, which latter were in possession of his pupil, Francesco da Siena, at the time Vasari wrote his life.

We now arrive at the greatest, as well as the last and crowning work of Peruzzi, the pyramidion of his fame—the celebrated Palazzo Massimi.

In the fifteenth century the illustrious family of Massimi possessed in the central quarter of Rome a spacious residence, situate in the Strada Pontificia (now known as San Pantaleo, from the name of the neighbouring church). There was nothing, however, remarkable in the building to excite attention, but there was one noble recollection attached to the residence—in 1445 Pietro Massimi established a printing press, and produced the first specimens of typography that appeared in the Eternal City. The editions which issued from this press are still known under the title "In Domo Petri de Maximis." Domenico, the son of Pietro, inherited this property. At the sack of Rome in 1527 (an event which I have already referred to) the mansion of the Massimi family was pillaged and burnt. After this fearful calamity, and when Rome was free from the horde of invaders, who for nine long months occupied the city, Domenico Massimi died, leaving his estate to his three sons, Pietro, Angelo and Luca, who being desirous of restoring the family mansion, consulted Peruzzi, and commissioned him to furnish plans for the new building.

The palaces of the two brothers Pietro and Angelo were adjoining to each other, but that of the third brother, Luca, was on the opposite side of the Strada Pantaleo. Peruzzi had great difficulties to contend with, in the arrangement of his plans, to accommodate them to the old foundations, in order to observe the requisite economy imposed upon him by his employers. Pietro Massimi, being the eldest brother, was the possessor of the larger of the two palaces, and as the family were originally

designated by the title of "Del Portico" (afterwards changed to that of "Delle Colonne") Peruzzi considered it imperative upon him to embrace a portico in his design. Le Tarouilly, who by some great good fortune became possessed of many of the original drawings of these palaces, is enabled to give us much interesting detail, which I regret the limits of this paper will not allow me to introduce.

In the noble volumes of "Les Edifices de Rome Moderne" no less than twenty-four plates, with several pages of letter-press, are devoted to the Massimi Palaces, and the author has evidently worked "con amore" upon these "chefs d'œuvre" of his favourite architect. The result is alike honourable to the master mind of the artist who designed the work, as it is to the care and labour of the illustrator; and it is in some measure consolatory to find that poor Baldassare, who was the victim of misfortunes during his lifetime, has had full justice done to his finest works, and that notwithstanding three centuries have elapsed since their construction, they are now presented to us in their full beauty, by the exquisite plates and accurate descriptions of his warmest admirer, Le Tarouilly.

The architect to the Massimi Palaces, in the adaptation of his plan to the limited and perplexing site, and the obligation to preserve existing foundations, under injudicious notions of economy, had no common difficulties to contend with; but the genius and invention of Baldassare overcame all obstacles. The curved line of the frontage, which would have been to many a "pons asinorum," was rendered by him a "pons triumphalis."

A detailed description of these two palaces would occupy more time than the prescribed limits of this paper will allow, but I am well reconciled to dispensing with it, as a glance at Le Tarouilly's plates will convey a far better impression of the works than the most elaborate accounts I could prepare.

Many of the Roman palaces are upon a larger scale than this, and are more imposing in their exterior architecture, but I doubt whether for beauty and grace of ornamentation any can compare with the Massimi.

The strict injunctions to economize prevented Peruzzi from employing any expensive or rare materials, for, with the exception of two marble columns only, in the loggia of the Piano Nobile, the construction is of Travertine stone, of brickwork faced with stucco, and of wood. This example is cited as a lesson of economy; and when we consider that the exquisite enrichments derive all their beauty and elegance from the masterly design and execution, without any aid from expensive materials or costly adjuncts, we may well join in the homage that has been bestowed upon Peruzzi by French architects.

I have already had occasion to remark that more than three centuries have elapsed from the period of building the Massimi Palace, to the time when Le Tarouilly was engaged in carefully measuring and taking note of every portion still remaining, and at the date of his labours, some thirty-five years since, when I had the gratification of being in Rome, the Massimi was generally in a fair state of preservation; but I am grieved to say that it now no longer remains so, for my excellent friend and our esteemed brother Fellow, Mr. John Davies, who last year made a pilgrimage to Italy, and revisited the scenes of his early studies after an interval or some thirty-seven years, thus describes the present state of the palace: "When I was in Rome, in October last, I went all over the Massimi, and was grieved to see the shameful state in which it was, the beautiful open vestibule and ceiling next the street falling to pieces."

Le Tarouilly concludes his notice of Peruzzi in these terms: "It was about the year 1532 that Peruzzi commenced the Massimi palaces, and at that period he was in the full energy of his talents. The taste and infinite variety he has displayed in the ornamentation are a proof how well he accomplished the work studied by him in the most minute details; but soon his health underwent a sad change. Intense anxiety and continued fatigue undermined his constitution; and it is even said that

poison, administered to him by some unworthy rival, anxious to succeed him as architect to St. Peter's, cut short a life so well occupied and so laborious." The probability of his having been poisoned is also mentioned by Vasari, but let us hope for the honour of our profession that the suspicion was not well founded, and at all events that it was not the work of any rival architect. During Peruzzi's last illness Pope Paul III. sent him 100 scudi by the hands of Giacomo Melighi, accountant of San Pietro, accompanied with the most friendly offers and promises, but the illness of Baldassare increased, the offers of His Holiness arrived too late, and poor Peruzzi died in 1536, at the age of fifty-five, in a state bordering upon misery. We cannot be altogether surprised at this melancholy termination, for he had to labour for a numerous family, and his income was never proportionate to his merits, or his services. According to Vasari, the rich personages who profited by his talents took advantage of the gentleness of his character, his modesty and extreme reserve, and they thought less of recompensing the artist, than they did of praising his works.

As in the case of Raffaelle, Peruzzi terminated his career by his chef d'œuvre, which he left incomplete, but, with much resemblance in their character, and in the nature of their talent, their fate was far different. Raffaelle lived in opulence, beloved, esteemed, and in the enjoyment of all his glory; Peruzzi, on the contrary, never gained a comfortable subsistence. His labours, although acknowledged, neither obtained favour or applause, and this unjust coldness of his own age has been in a great measure perpetuated. His name has never become popular, and is but little known, excepting by those interested in the study of architecture. How is it then that he has not become illustrious? for he was at the same time a great painter and a skilful and sublime architect. Such are the unjust ways of blind Fortune, and the capriciousness of Fame!

Peruzzi's most distinguished pupil was Sebastiano Serlio, who was twenty years of age at the time of the lamentable death of his unfortunate master. Serlio remained in Italy three years after this event, and then proceeded to France; where he executed, together with Pierre Lescot, Jean Bullant, and Philibert Delorme (all worthy students of the same school) some of the finest works in architecture that France possesses of that period, and it is I believe principally owing to the careful study of the works of such master minds as Vignola, Peruzzi, and their disciples, that the French architects have acquired that exquisite taste in ornamentation, so prominent in all their works. It is to the same pure sources that I would most earnestly entreat the students of our own country to have recourse, looking forward to receive the grateful tribute to talent by their brother architects, as in the distinguished instance we have had before us this evening, rather than being deterred by reflecting on the misfortunes sometimes attendant upon genius, as in the case of poor Baldassare Peruzzi.

Chronological Table taken from Le Tarouilly's Work—

Names.	Date of Birth.	Death.	Country.
Alberti	1398		Florence
Sangallo (Giuliano)	1443	1517	Florence
Bramante	1444	1514	Castel Durante
Sangallo (Antonio)	1470	1546	Mugello, near Florence
Michel Angelo	1474	1564	Caprese, near Arezzo
Sansovino	1479	1570	Florence
Peruzzi	1481	1536	Accajano, near Siena
Raffaele	1483	1520	Urbino
Giulio Romano	1492	1546	Rome
Vignola	1507	1573	Near Modena
Palladio	1518	1580	Vicenza

From this it would appear that Peruzzi was 26 years older than Vignola, and 37 older than Palladio, 11 years younger than Antonio Sangallo, and 7 younger than Michael Angelo.

ON THE CONSTRUCTION OF DOMES.

By T. Hayter Lewis, Honorary Secretary. Read at the Royal Institute of British Architects, May 16th, 1859.

Having some few years since to erect a dome of very considerable span, I was surprised to find how little practical information existed on the subject. Being thence led to investigate and to make notes relative to domical structures generally, I have now put them together, in the hope that others may also be induced to give the result of their experience and studies respecting this beautiful class of buildings—the most beautiful termination, it appears to me, for any grand architectural composition.

In the present Paper it would not be convenient to enter into elaborate mathematical investigations. I shall, therefore, merely refer to the principal theories on the subject; describe the construction and the cause of failure of some few of the most celebrated domes; and then try to sketch out some broad principle for adoption.*

The theories best known are those of Dr. Robison, of Venturoli, and of Rondelet.

Dr. Robison's was, I think, first published in his "Mechanical Philosophy," and then re-written by him under the article "Arch," for the "Encyclopædia Britannica:" it has been referred to in almost every subsequent work on mechanics.

From this theory, the particulars of which may be found in the works to which I have alluded, are deduced directly the following somewhat startling results:—that a dome starting from a perpendicular drum could not stand at all; and, that a reversed curve is a much stronger form than the usual insistant one.

Venturoli's theory is given by him in his "Treatise on Mechanics," a very good translation of which has been made by Mr. Cresswell. The results are very much the same as Dr. Robison's.

Rondelet's theory is given in detail in his well known work on Construction, and it has been very well condensed in Gwilt's admirable Encyclopædia. It is of a much more practical nature than the others, and assumes that the weight of the upper part, pressing outwards, is counteracted by that of the lower part; the difference of the two forces giving, so to speak, the measure of weakness in the dome.

There is another theory to be found in the well known "Parentalia," but to which I should not here allude, were it not almost the only one mentioned in that work; and although it may now appear almost absurd, the author's extended notice of it would induce us to believe that it must have been favourably accepted in his time. It will be found given at considerable length in any edition of the "Parentalia." It refers, however, more particularly to arch construction.

Now, I have too great a reverence for the study of mathematics, and I am too sensible of the advantage that our profession derives from that science, to say one word that might appear to slight it; and, indeed, the great names I have mentioned would prevent my speaking so strongly as I am obliged to think of their theories, had I not found words as strong used by one of the most noted of the authors themselves, Dr. Robison.

In one of the articles to which I have referred, he gives an analysis and description of the arch. He puts the theory before his readers in a perfect manner; shows how beautifully the exact size of

* I must here express my obligations to Professor Donaldson, who kindly lent me any of his drawings I selected to copy, as well as to Mr. Hesketh, Mr. Nash, and others, for similar assistance.

every stone, and the curve of each arch can be calculated; and, in fact, leaves us quite satisfied that the theory is correct. Then, having made everything so clear, he quietly informs his readers, in an equally clear manner, that the speculations of all the eminent persons who have written upon it are of no practical value whatever.

The fact is, that the most celebrated of these theories assume as a basis that the arch or dome is formed of layers of stone, sliding freely upon each other, without bond, friction, or the interposition of cement—conditions which never have occurred, and which never can occur in actual practice. Moreover, it is really, for all practical purposes, almost waste of time to deduce calculations for constructing stone domes at all; for, curious as it may seem, I believe that there is not existing, and that there never has been built, any stone dome of very large size, since the time of the Atridæ at Mycenæ.

The construction we have to consider, if it is to be of any practical use, is of brick, and this material is so combined, in execution, with cement, that the theoretical joints do not really exist; for, with good cement, the bricks themselves are as likely to yield as any of the joints. In stone construction the case is different. The thinness of the mortar in the joints makes them really what their name implies, and we should consequently approach near to, though we can never actually realize the conditions of the theory.

Now, in addition to the difference in the materials, we must also remember that the details of construction in the domes now existing vary very much, and that they are by no means to be resolved by one theory. As I propose to notice actual examples only in this slight sketch, I must ask you to examine with me, briefly, the principles of construction of the most noted. The first to which I will allude is the celebrated tomb of the Atridæ at Mycenæ.

I need scarcely mention that it is formed of horizontal layers of stone, in large blocks worked to the form of the curve on the inside only, and without, so far as I am aware, any cement in the joints. It is of considerable size (48 feet 6 inches in diameter), being about that of St. Vitale, at Ravenna, and somewhat larger than that of St. Stephen's, Walbrook. The construction displays great simplicity, and theoretically, no power short of what would actually crush the very stones, could, so far as I can see, break this dome. The pressure at every joint is perpendicular, so that there is really no outward thrust, and the tendency of each stone to fall inwards is met and destroyed by the opposite thrust of the other stones. If the task were now given to erect a dome of a pointed vertical section, with large masses of stone, such as the architects used of old, I doubt if a better mode of accomplishing it could be found.

The next examples are those of the well known Pantheon (142 feet diameter), and of the Temple of Minerva Medica (81 feet diameter); baths or temples, as you will.

These domes are formed of several ribs of brick, which appear to have been built quite distinct from the filling in work between them; just as in early Gothic vaulting the various ribs were first formed and set in their place, and then the intermediate light chalk panels added to complete the whole.

This opinion as to its construction is confirmed to a certain extent by the way in which we know, to our regret, that the dome of the so-called Minerva Medica has perished. But a few years ago the ribs stood firmly, although a great part of the filling in between them had disappeared.

I believe the same might occur at the Pantheon, and that its skeleton construction is just that of York Chapter-house; so that, without at all altering the leading principles, we might arch the filling in to steady the ribs, and convert the great dome of the Pantheon into a gigantic resemblance to its graceful little English rival. Whether or not the change would be approved, it is not for me to

surmise ; but that the vast building would at once display, as it never has displayed, its enormous size, I have no doubt whatever. Setting, however, this question aside, it seems to me that, in this greatest and noblest of domes, we have the essentially Gothic principle of security by abutment, and not by a tie ; for if, as I believe, the stress be borne by the great ribs, the tie, to be effectual, must clearly be straight from one of them to the other ; otherwise, if we put it in the circular form, the feet of the ribs would spread outwards, until the tie became straightened. But if we fill up the space between the ribs, this filling in would serve to strut them ; and preventing, by its circular form, the tie from straightening, may occasion it to act. If, therefore, in the Pantheon dome there be any real binding courses, I believe that they act as ties to the ribs only by the filling in acting as strutting. But I do not believe that the tie exists at all, but that the stability of the dome is secured by the strong abutment only.

The next example is the dome of S. Sophia, at Constantinople, of about 110 feet diameter. Of this we have ample information, beginning with the history of the building, so beautifully condensed by Gibbon, down to the recent elaborate drawings and description of Salzenberg. Unfortunately, the ancient accounts, so clear and precise, are erroneous in one important particular ; for while all state that the dome was finally reconstructed as it stands, of pumice stone, or light Rhodian bricks, Salzenberg informs us that no trace of these can be found, and that it is formed altogether of ordinary well burnt bricks. It appears that the four great piers at the angles of the square on the plan were the only supports at first adopted, and that the pendentives and dome were formed on them. The pressure of the eastern and western arches springing from the great pier was resisted by four walls, forming transepts running north and south. Against the eastern and western walls respectively abutted two semi-domes. The superstructure having given way towards the east, taking away the semi-dome on that side, the eastern pillars were strengthened, and the dome was again turned, but it again gave way before it was completed. Strong buttresses were then built to the east, and a dome (this time of pumice stone) turned for the third time. But it became cracked and split, the arches under being so fractured that those on the north and south sides required to be filled in with the three storied arcades now forming such prominent features in the interior. This dome then stood awhile ; but it was destroyed by an earthquake, and was subsequently rebuilt.

All this narrative would show that the substructure was the defective part, the great arches not having sufficient abutment ; and that, whether the dome as first built would have stood or not, not one, however sound in itself, would have stood upon such a base. Whether constructed of pumice stone or of light or heavy bricks, the recent dome seems to be of homogenous construction, without separate ribs ; answering, in fact, to our ordinary idea of a dome, as typified by the *internal* brick dome of our own St. Paul's. The general thickness varies from about 2 feet to 2 feet 6 inches. It has strong buttresses as abutments (8 feet 6 inches thick) above the springing, and the walls under are excessively thick, as compared with the thickness of the vaulting.

The next example is the dome at Beejapore. It is formed of a solid mass of brickwork, put together with good mortar. It is 124 feet diameter, and varies in thickness from 10 feet 6 inches at a little above the springing, to 10 feet near the top ; so that it is four times as thick as that of S. Sophia, with a diameter one-eighth larger. I have few data from which to form an idea of the strength of the material, but I assume the general construction to be on the same principle as that of S. Sophia, but differing from it in weight, thickness, and bearings.

The dome of the Cathedral of Florence is 138 feet 6 inches in diameter, octagonal in plan, with a great rib at each angle, and two smaller ones on each face. These are connected together by a thin casing, about 2 feet thick outside, and a thicker one (averaging about 7 feet) inside, with tiers of arches turned between the ribs, in order to strengthen these casings. At the foot of the dome is a

strong tie, composed partly of timber and partly of iron ; and the whole mass rises clear above all the surrounding parts of the edifice, showing that the dome is quite self supporting, and that it derives no strength from external abutments of any sort. It supports a heavy ornamental lantern ; being the first great example in which this weight, extraneous to that of the dome itself, has to be supported.

Some settlements appeared soon after its erection, but the whole seems to have stood without any serious defect until the end of the seventeenth century, when several fractures appeared for the first time, or were then considerably increased. They are said to have extended through the whole thickness of the dome, to have descended also, through the tambour, to the main arches, and thence, in a clearly traced line, down to the ground. It was, therefore, the opinion of some, that the foundations only were in fault ; whilst others considered that the dome had opened from lateral extension, thereby bursting open the tambour, &c., and that it should be encircled by iron ties, to prevent further spread. Fontana was of this opinion, and his advice being adopted, three iron ties were prepared. However, before they were completed, the contrary opinion, advocated chiefly by Nelli, prevailed ; the ties were not fixed, and the fractures were merely secured by dovetailed cramps. The present stability of the dome proves that this remedy was effectual.

The dome of St. Peter's, the design of Michael Angelo, though carried out by Fontana, is about 139 feet in diameter, and differs from that of Brunelleschi just described, by being circular instead of octagonal on plan ; but like it, is formed of sixteen ribs, united together by a double casing, the outer about 2 feet 10 inches thick in the centre, and the inner 6 feet thick. It stands on a tambour, without abutment at the springing ; but a little below it is encircled by a peristyle, not, however, of mass enough to act in any great degree as a buttress to counteract the spread of the dome; and at the top of all is a heavy lantern. The dome is built of brickwork. Four ties were first inserted, at different heighths. These proved ineffectual, the dome becoming very much fractured ; and in 1743 two others were added, encircling the tambour and peristyle below the springing. The next year three others were added round the exterior of the dome ; one near the top, a second half-way down, and the third at the foot. In 1748 another tie was put round it, at some distance above the springing ; and this is, I believe, the last addition, the dome having appeared to be secure since that time. If my theory of dome construction be correct, this tie is the *only one* required.

I come now to the important question of the double wall or casing of this and of the Florentine dome. I scarcely know the general idea respecting this system of dome construction, but so far as I have been enabled to ascertain, it seems to be considered a method of obtaining strength by a clever arrangement of the material ; much in the same way as we obtain it by casting a given amount of metal into a large hollow column instead of a small solid one.

Now, let us try how these domes could be broken, and we shall then get some clue towards calculating their strength.

Taking any one part separately, it might be bent or broken horizontally, as a bow might be ; or it might be similarly broken in its perpendicular section by the weight of the lantern pressing on the top, whilst the bottom was secured by an abutment or tye. This weight would act upon and be resisted by the perpendicular section, in the same manner as in the large boxed iron cranes now used in the docks, &c. For, if we may apply to these magnificent domes so homely an illustration, we may consider each pair of two ribs composing them, with the casings between, as huge bent tubular girders, of almost the same outline as those forming the dock cranes.

Now, any force that we can conceive likely to act as destructive to the dome, would produce a strain on the outer flange or casing tending to tear it asunder, whilst it would endeavour to compress or crush the inner one ; we should therefore expect to find (supposing that the great architects who designed these domes adopted the hollow walling for strength) that they had arranged them as we

should arrange the metal in a girder, distributing it in different amounts, in proportion to the forces that they have to resist. It is clear, however, that this was not the idea of Brunelleschi, or of Michael Angelo; for the external casing of their domes has no provision for resisting extension, whilst the materials of the internal vaults appear from their thickness to be intended to resist direct compression only.

I know of no other way in which the double vault could be intended to be used so as to give strength. It could not be with the notion of obtaining it as we do in a square hollow column; because a direct strain, perpendicular throughout to the direction of its length (an element necessary to the stability of a column) could not be brought upon it. It would, in fact, give way in the curve, as a bow would when pressed at the ends.

Brunelleschi's own description, as recorded by Vasari, seems to give us clearly his idea of the whole, and to show that his plan was to obtain the necessary strength by the ribs, and not at all by the double vaulting. He states that the external vault is necessary in order to protect the inner one from the weather; and he directs that the latter, after it had been raised to a certain height, should be formed of the lightest materials that could be found, whilst the ribs were to be built up throughout of solid stone.

I apprehend, therefore, looking at the whole question, that Brunelleschi's idea was to construct the ribs of a certain form and thickness, and then to fill in between these ribs, so as to stiffen them and complete the vault inside and out; leaving a hollow space between, in order to lessen the weight as much as possible. The inside casing, both at Florence and at Rome, is made the thickest, as it has to bear, to some extent, the strain of the ties.

We have in England a beautiful example of the way in which stone ribs will stand when the rest of the vaulting has fallen, in the picturesque ruins of Mayfield, one of the most interesting remains in our southern counties. The whole of the ceiling, whatever it may have been, has disappeared, but the ribs still span the width of the great hall strongly and boldly; and with a few cross arches to steady them, and take the strain of the ties, I believe that the grand stone ribs of Brunelleschi's skeleton would do the same.

The last example I shall quote is the dome of our own St. Paul's; the first, I believe, of its type, but the general system of construction of which has been followed ever since. I do not wonder at its being thus copied; for the majestic effect gained in it by its architect has never been surpassed, and the whole composition of the exterior, at least, is to me the most glorious specimen of Italian architecture.

There is no direct abutment to sustain the thrust of its cone, which, contained by its tye, and held together by the general goodness of the work, stands firmly upon the tambour, without exerting any expansive force. I believe that in this cone we have the true secret of domical construction, which shows itself here in its simplest form, unconcealed by the curved outlines which in other cases mask, whilst they adorn the reality. Secure this cone at the foot, and I know of no power that would break it, short of what would crush its materials to powder. Bend the straightness of its sides into a curve, so as to enlarge it to the form of a dome, and as the curvature is increased the strength is lessened. Where would this curved dome break? Clearly, if it were weighted at top, and the foot kept from spreading, it would break like a bow, between the two points. Tie in this weak part, and the danger at that part disappears, being transferred to two other points between them.

In this view it will be seen that I look upon the fabric as being necessarily secured by a system of ties; and that it is not to be safely trusted to the independent strength of its own construction.

Assuming, however, this latter notion to be correct (as undoubtedly it is in theory), and that each particular ring of the dome is, by the goodness of the bond and the strength of the materials, strong

enough to resist the pressure tending to burst it outwards, we might suppose that it would be self-dependant, and safe, without any extraneous guard of iron or other tie. But I apprehend that, in practice, this construction would be decidedly unsafe. Doubtless a vault of good brickwork laid in cement would be strong enough to resist any strain that the weight of a dome above could bring upon it, for we know its strength to be such that it is uncertain whether the bricks or the joints would break first, but in practice it is not safe to trust to this extent; strong as the work may be, the slightest yielding in the foundations will cause an unequal bearing in the weight above, and in a moment rend the strongest work. We may, indeed, imagine that a dome on a small scale may be formed of materials so strong, and yet so light as to be, effectively, of one piece only, as though cut out of a solid block of stone, as is the tomb of Theodoric at Ravenna, or formed in one piece like a reversed cup; and in such a structure, no doubt, from the extreme tenuity yet strength of its substance, no ordinary rules for estimating the strength will apply.

Such also may be, and probably is the case with such small semi-domes, for instance, as have been put up by my friend Mr. Scoles. One of them has a diameter of 30 feet, and is formed of four courses of plain tiles in cement, altogether $4\frac{1}{2}$ inches thick. I believe that no failure has occurred in this kind of construction, which I have, in my own practice also, found to succeed very well. The strength, in fact, of this kind of work is so great, while its weight is so little, that it would perhaps render the fabric independent, to some extent, of a failure in the foundations, and unless it were heavily loaded in some particular part, would require scarcely any abutment or tie. Certainly, this may and does suffice for small works; but if we extend the size, we shall find the plan a somewhat dangerous one. We may strengthen the vault—put 2 feet of thickness where theory tells that one will suffice—and so trust our theoretically self-tied, unbuttressed dome to stand as the great ones of old have stood. But in adding to its strength we shall have doubled its weight; and should the carefully secured foundations yield only a hair's breadth to this weight; should a little spring but carry away, gradually and unnoted, grain upon grain of the sand on which the massy piers of the dome may rest, soon will come the inevitable settlement, and our massive dome will rend and break away as though an earthquake had rocked it, and the more certainly in proportion to its very massiveness.

Send but a single fracture through the thickness of the vault, and its self-tied structure is resolved into two or more separate parts; therefore, although I do not doubt that a dome may be made so strong and well compacted as to need no extraneous tie, yet the risk of fracture is so great that we ought not to depend upon the safety of such construction only, but insure for it such an abutment as may resist thrust, or such a tie as shall be free to some extent from the risk of fracture from the pressure of the mass above, in case a settlement should cause the latter to press unequally.

One instance, indeed, the well known one of St. Vitale, at Ravenna, exists, in which the construction is so arranged as apparently to provide against the necessity of any extraneous aid.

The dome is formed of a triple coil of earthen jars, the end of each being socketted into the top of the one adjoining in a very ingenious way, so that it seems to me that if a settlement were to occur in the substructure, this peculiar arrangement would allow of a slight readjustment of the coils without destroying their connection. The only guard against the outward thrust is, so far as I am aware, the weight of the walls above the springing; and, altogether, this dome appears a very fine piece of construction, and worthy of a close and detailed investigation. In fact, I know of no other existing which combines all the qualities of strength, lightness, and flexibility, without the aid of any extraneous tie; but it has not to bear the great weight of the lantern which presses so heavily on the Florentine, Roman, and London dome; and I should hesitate to speak too confidently of its capacity to bear it, even if its outline were raised to that of a pointed arch.

Passing, then, this example by as one of doubtful authority, and looking only on the form of

dome construction most usually adopted, and supposing its work to be good and solid, there will be little principle of the arch involved in its construction, whilst it might in fact be built up in a solid mass like the arched rib made by the elder Brunel some years back, by building it out from each side of a pier so as to maintain the equilibrium of the two half arches.

We know that he proceeded with the construction till each semi-arch overhung sixty feet, and if the corresponding half had been carried out, the two together would apparently have formed one arch of 120 feet span; in the same way that two raking pieces of timber would form an arch by abutting against each other.

Now, how should we break one of these curved ribs, assuming it to be secured at the bottom and loaded at the top with the heavy weight of the lantern?

I apprehend that it would snap at the lower part of the bend, and at that point therefore we should want the tie; if secured there, any weakness would be felt at an intermediate part of the curve. But supposing that instead of a curved beam we had an angular one, and that it was carefully secured at the angle, it is obvious that we should have the form of the Mansard roof alluded to by Dr. Robison; and I know of no power that could break it, short of actually crushing it.

Now we have this condition actually fulfilled in the cone of St. Paul's, which, so long as the tie exists, may be considered indestructible; let us, therefore, take this as a starting point, and going one step further, suppose that Wren wished to make, as Brunelleschi did, the shell of the fabric form its outline, inside and out, instead of concealing it as in St. Paul's.

Add any form of curve we like, the cone itself would still remain as the great constructive skeleton, to which any super-added mass would serve only as a clothing. I believe that this is the real secret of constructing domes whose size exceeds the safe limits of a brick or other beam, and that we ought to make such domes approach so closely to the conical form that their section should include that powerful outline within their thickness.

I do not say that a great dome cannot be safely erected with other outlines, because by careful attention to the goodness of the materials, and to the general bind of the work, it may, no doubt, be made secure. But I believe the form above mentioned to be the safest, and that any departure from it entails risk. To test the correctness of this opinion as far as possible, I have applied the form to the sections of the domes of the Pantheon, of St. Peters, and of the Cathedral at Florence, with the following results:—In the Pantheon a cone of 2 feet thick (about 6 inches thicker than that of our St. Paul's), is contained in the curved surface from the horizontal line at top to the abutment. In the Florentine example a cone of much greater thickness is contained within the curved section from the foot of the lantern to the tie originally inserted by Brunelleschi, and never added to since. In St. Peter's a cone of similar thickness is contained in the curved section from the bottom of the lantern to the tie last put in, since which time no other has been, I believe, required.

The rule bears, of course, upon one particular class of domes, in which a top mass of great weight has to be borne independently of the fabric itself.

There are, however, other cases in which this conical form does not obtain; but in these, so far as I am aware, the weight of the lantern is wanting, so that the curve has only the weight of its own section to sustain. Such are the domes of S. Sophia at Constantinople, and the celebrated one at Beejapore. Having no personal knowledge of the Indian domes I speak of this last example with much diffidence, but judging from Mr. Fergusson's excellent description, I should say that the enormous thickness of this well-compacted roof renders it, as it were, equivalent to being cut out of one solid stone.

I am the more satisfied that this is a correct idea respecting these domes, because it is stated that in some of them, though the foundations have given way, the domes are left intact.

I shall, however, assume it to be composed of somewhat inferior materials, so as to render the outline of consequence, to ensure stability.

In these flat-topped domes we have to provide both against the weight of the mass, and the extra weight after every snow storm ; and although this is not likely to demand the precaution of the single cone, still the conic principle modified must, I think, be carried out ; and we must provide against the strains as we should in a Mansard roof, by inserting a tie at the base of each cone (answering to the roof strut) varying in strength in proportion to the angle and the weight. But it is clear that there is a limit to the angle, beyond which it would not be practically safe to trust to the cone, and, for reasons too long to mention, I think that 40 degrees with the horizon should be the limit.

Beyond this upper cone there remains an almost horizontally flat portion (seen most clearly in the example at Beejapore) of such evident weakness, that Brunelleschi was of opinion that it could not be strengthened sufficiently to bear the weight of a lantern, and for this reason he gave his dome the section of a pointed arch. It is undoubtedly weak, and cannot be treated in the same way as the lower parts.

Let us suppose a solid ring at the top of the cone, leaving an opening as at the Pantheon. So far it will be safe. We have now to fill in this space with brick or stone work capable of bearing the superincumbent weight ; and this filling in must, I think, be considered as a solid curved beam, cut out of a mass, and strutted well at the abutments, conditions requiring no great strength where there is no lantern.

In conclusion, I would briefly recapitulate my opinions respecting the construction of domes.

I consider that the essential element of strength in a dome is a straight cone (whether simple in one unbroken length, or compound in two or more lengths) comprised within the section of its vaulted covering. That the base of each cone must be securely tied. That although, for the same reason as in ordinary walling, we ought to secure by bonding and perfect bedding this vaulted covering in every part, yet, with good materials and work, these ties at the base of the cone are the only ones theoretically required. That the strength of such ties at any part is to be found by resolving the weight, by the ordinary resolution of forces, into the lateral pressure at that part. That in domes with heavy weights at the apex the straight cone is the only safe one to adopt. That the vault may be made strong enough by ribs alone, and that when these ribs are required not to project beyond the general face line, inside or outside, double vaulting, as at Florence and at St. Peter's, may be safely used, but only as a means of lightening the weight. That although, by the goodness of the work, domes may be erected strong enough to bear any amount of weight without any extraneous tie, yet that such tie should be always inserted as though the ribs were quite separate, in order to guard against settlements. Lastly, that the thickness of dome will be sufficient if it include within its section a cone, necessary to bear the weight.

Though believing these views to be correct, it is with considerable diffidence that I put them forward, as they are, I have reason to think, opposed to those entertained by some who are well qualified to form a judgment on the subject, which is, indeed, one not to be entered on lightly. No one can forget the sense of solemn awe with which he has viewed the gigantic vaults of which I have spoken : for my own part, when engaged in investigating the secret of their build, in laying bare as it were the skeletons of these great works, and touching at every turn the memorials of such men as Brunelleschi, Michael Angelo, and Wren, there arises with the ordinary methodical calculations respecting strength and materials a strange feeling of reverence for the works we have been examining, and of distrust of my own ability properly to comprehend them.

In the discussion which followed the reading of Mr. Lewis' paper, some of the Members present expressed the wish that the subject, being of much interest, should be resumed on a future occasion. Thanks having been voted to the Author, the meeting adjourned.

ON THE ARCHITECTURE AND GENIUS OF SIR CHRISTOPHER WREN.

By G. Wightwick, Architect. Read at the Royal Institute of British Architects, May 30th, 1859.

The native sovereignty of genius was, perhaps, never despotically independent of the circumstances attending its birth and earliest development; and, when we read that the infant energies of a boy's mind were industriously directed by a father "of great scientific knowledge and of extensive attainments in literature and mathematics, with considerable skill in the noble art of architecture," we are not to wonder that "tractable precocity" should resign itself to that particular lead, whose results constitute the popular monument of its fame; but which, after all, are no greater testimonials of power and accomplishment than other evidences confined to the appreciation of the few.

Under such circumstances was manifested the genius of "that miracle of a youth," Christopher Wren, who, in his twenty-third year, was recognised by Evelyn as "a rare prodigy of universal science." The preeminent distinction of his mind, however, was not its capacity for receiving knowledge, but its application in augmenting the stores of science, and, still more particularly, its inventive power in the constant produce of the most useful novelties. The creative, in short, as the most essential attribute of genius, was Wren's in a marvellous degree; and, in respect to the universality of his attainments and powers, it may be emphatically remarked, that, had he never been known as an architect, he would have been by so much the more known as a man of scholastic literature, philosophy, and science. Before he comes before us as an architect, he brings the highest credentials from the classic professors of Isis, the mathematicians of Cam, the astronomers, chemists, and scientific members of the Royal Society, and from the mechanic in all his then known means of operation.

All that Vitruvius requires of an architect was Wren's, without any especial architectural intent; but as Mr. Cunningham observes, "his mathematical acquirements gave him extensive command over the very principles out of which true architecture arises." Perhaps we should rather say, he found in his mathematical erudition the chief (or one of the chief) of its principles; for in the varieties of physical science lie others also of great suggestiveness, and the architecture of Wren arose out of his varied knowledge—his knowledge of all things necessary to its development, as the issue not more of geometrical beauty than of material science and constructive perfection. In short, the genius of Wren had induced the acquirement of every accomplishment as an operative builder, before he was called upon to cultivate the artist. He had inherited from his father a peculiar feeling for architecture as a fine art, though for many years it had occasioned little more than the external observation by which he had naturally imbibed an ever-increasing sense of the beautiful, awaiting only the occasion for his analysis of its just principles; and, when the occasion came, a comparatively brief appliance of his acute perception, acquisitional capability, and thoroughly informed invention, was necessary to the result finally exhibited in the august amplitude of St. Paul's cathedral.

And whence came his ability as an artist? Certainly not from academical or official instruction, for, until the age of twenty-nine, when he was suddenly called upon to assist Sir J. Denham as Assistant Surveyor General, we hear nothing of him even as an architectural amateur. So immediate, however, was the manifestation of his ability as a practical architect, that at the age of thirty-one he erected his first building, the Sheldon Theatre, at Oxford. The truth is, he was at that time, more than any other man in the kingdom, equal to anything of national importance that might be required; being indeed the "admirable Crichton" of mind in its all-applicable power and comprehensive acquirements. The leading mathematicians of Europe had visited England to see the famous Wren; a

distinguished classic had spoken of his poetical accomplishments as raising him even above Ben Jonson as a translator of Horace; and, when Newton was a tyro, Wren, with Boyle and Hooke, was opening the way for the former with "the greatest contributions to science ever yet produced." The love for architecture, therefore, was only a part of his sympathy for everything that could address a man of genius; and had there been no mathematician of eminence besides himself, nor any remarkable poet, painter, sculptor, astronomer, chemist, optician, or mechanic, Wren would have been all or any of these, as the necessity of the time might have required; but Inigo Jones was dead, and there was no architect. Who, then, could be called upon when the great fire of London had left the city with no architecture? Who, save Wren? He had not, like Jones, visited Italy to study its ancient and Palladian Buildings, though he did make "a trip to Paris," where he thought he saw inimitable things, unconscious, in his modesty, how greatly he was to surpass them. He read his Vitruvius; speedily gathered what knowledge was available, immediately anticipating the results which come to others by slow degrees; and in three years from his first operations as an amateur architect, he had "concentrated all his powers on his new study, to the diversion of his mind from its former pursuits." The true character of his genius, as an architect, is strikingly shewn in his having adopted no mannerism from his teachers, or from the examples that had addressed him. Having mastered with readiest facility all the details of classic design, he obeyed the sole promptings of his native imagination, fancy, and independent (though educated) taste, in the production of models which, to reverse his own expression, "Bernini might have been willing to give his skin for;" though, of course, we now allude to the greater and more select examples on which his fame is grounded.

And now, in the estimate of his genius as an architect, we may begin by referring to his very qualified regard for our Mediæval examples. It is to be presumed he looked upon our Anglo-Norman churches as little better than picturesque, but clumsy, free imitations of the Roman method; and we know that he viewed their pointed successors as a compound of the same with the "Saracenic." "Gothicism," with Wren, meant barbaricism. The barbaric splendour of our old cathedrals he admitted, but, in his report on old St. Paul's, he speaks of the "carelessness and want of accuracy in its builders"—of the "good Roman manner," as opposed to "Gothic rudeness"—of "the lean shaft" of the old "steeple:" and calls his design for the new St. Paul's, as executed, "the Gothic rectified to a better manner of architecture." But though Gothic design seems at that time to have been almost ignored, as unworthy the name of architecture, Wren was not insensible to the magnificence of the cathedral of Salisbury, which, he says, "by a venerable kind of grandeur, strikes the spectator with a sacred joy;" and which he commends beyond divers Gothic buildings of later date, while in his surveys of that edifice and of Westminster Abbey, he manifests a marked sense of much that was due to the Mediæval builders.

It must, however, be admitted, that Wren was influenced by the general distaste of his day for Gothic art, and the question remains, what he would have done had he lived at the time of its revival? It is likely he would have been for systematizing Gothic design, and for bringing it into geometric propriety; subjecting it to those laws which should govern all styles, the "complete beauty" of which, to use his own words, "is secured in variety of uniformities."

We may not certainly adduce his Westminster towers as any evidence of what he would have done; but there is a little in the tower of St. Michael's, Cornhill, a little more in the bell tower of Christ Church College, Oxford, and much more than a little in the steeple of St. Dunstan's in the East, to indicate what, under the more propitious circumstances of the present day, Wren might have accomplished as a Gothic revivalist.

The consideration, however, more fairly and assuredly affecting our estimate of Wren's genius as an architect, is that which has reference to the time and circumstances of its operations.

The time prescribed the style to be adopted. The approval awarded to Inigo Jones' application of a Corinthian portico to a Gothic cathedral left it a matter of certainty that the European taste for classic art had no exception in England. While Wren was being rocked in his cradle, the church of St. Peter at Rome was being completed; and in Paris, the old cathedral of Notre Dame had no more influence than Westminster Abbey in London, to preserve any feeling whatever for Gothic design. The Louvre and the church of the Invalids, in the French capital, arose in obedience to the same common impulse, which produced the Whitehall banquetting room and the cathedral of St. Paul in the British metropolis. As we have seen, however, Wren obeyed not the dictation of fashion only, but has left on record his practical reasons for selecting the "Roman manner of building," as most fitted for the permanent glories of architecture. The time, therefore, was rather favourable to the development of his personal ideas than imperative in governing them, and he adopted at once, without any essential change in detail, the style presented to him by his immediate predecessors and cotemporaries. The new cathedral was to be, and Wren's genius was at hand that it might be in perfection; subject only to one most injurious impediment, viz., the unhappy meddling of the papist party (then in power), whose leader (the Duke of York) was determinate in the reemployment of the old cathedral form or plan, which grievously militated against the admirable originality of our architect's independent conceptions.

No more than a simple reference is necessary to the plan of Wren for rebuilding London after the fire. It is, of course, chiefly a thing of ingenious and judicious arrangement, reconnecting the severed parts of the city which had escaped destruction; the adoption of which would have been a noble preparation for all the architecture which has since been presented under such lamentable disadvantages.

In contemplating the floor plan of the rejected model of St. Paul's, we immediately see how its author has set at nought the influence of familiar custom as a cause of beauty. We have a general outline and internal disposition of parts perfectly original. Instead of the ordinary rectangular combination, we have the square, the curved, the polygonal, the concave, the convex, the recessed, the salient; affording the most varied play of full light and half light, sharp in contrast with shadow and shade, or softly gradational the one into the other; while the outline of the plan includes, within its full bodied expanse, the cross as the skeleton form, whose dome crowned centre is the "heart of the mystery."

In the existing cathedral we see the old Gothic model Romanised, with a dome *vice* a central tower, and, instead of flying buttresses openly exhibited, a decorated screen, looking like an upper story, concealing them; but in the model we have a design not less original than magnificent, with artistic feeling far exceeding what is displayed in any single building of ancient or modern times. The refined *pictorial*, of bulk and varied form, here presents itself in lieu of the Gothic *picturesque*, of attenuated length and transeptal interruption.

And now leaving the outline, let us contemplate the floor plan. Let the reader especially imagine the first long and narrow perspective from the West door; the forthright and divergent views, on his passing the arch next beyond the vestibule; the view on just entering beneath the great cupola; that from the centre of the same; and that from beneath one of the diagonal cupolettas. All this justly considered, he may so conceive of the magical effects realised as to see, "with his mind's eye," how comparatively commonplace are the effects produced in the existing cathedral. Well may we believe that its designer wept at the rejection of his model; and well might we weep that it was rejected!

In the model the portion for the choir is of a form much more adapted to the purposes of

protestant worship than in the building, and of a capacity equivalent to what Wren pronounced the maximum size for an auditorium, in which all the sitters may distinctly see and hear the preacher; *i. e.* it is equal to a room of 80 feet long and 50 feet broad, exclusive of the space required for the organ and the communion recess. Wren was the last man in the world to design a building without a full regard to its use. He rightly felt, however, that a cathedral is not a mere thing of practical utility; but that it should be the offering of art's best to the Giver of artist genius. In St. James' church, Piccadilly, he considered the matter on mere utilitarian grounds, and even there produced a structure, the interior of which remains a monument not more of his scientific economy than of his feeling for the beautiful.

Having commented on Wren's own, we have now to examine St. Paul's Cathedral as it exists; a building whose beauties are equally his own, and whose defects (mainly occasioned by interference) still leave it unequalled, as a model, by any structure in existence. In its general external mass it exhibits a wondrous combination of majesty and elegance; the expression of amplitude in the cupola of its interior is without equal; and if the architect's doings had found co-operation in the sculptor and painter, the London St. Paul's would have yielded to the Roman St. Peter's only in size.

Under the determined predeliction of Wren's dictators for the old cathedral plan, his "genius was rebuked;" and all he could do was to modify the prescribed form, so as to reconcile, as far as possible, a new body to an old habit. Even in this he was still beset by meddlers; and it was by command of the popish Duke of York, that the North and South chapels, near the Western end, were added, to the reduction of the nave aisles, and the lamentable injury of the return fronts of the two towers, which therefore lost in apparent elevation by becoming commingled with pieces of projecting façade on the North and South sides. Thus were produced the only defects in the longitudinal fronts of the church. The independence of the towers is destroyed; their vertical emphasis obliterated; and a pair of excrescences is the consequence, which it were well to cut away. All that could be done to diminish the evil was accomplished; but no informed eye can view the perspective of the cathedral from the North-west or South-west, without seeing how no architect, who only admitted a "variety of uniformities," could have intentionally formed a distinct component in an exterior of otherwise uniform parts, by a tower having only one wing, and that, too, flush with its face! With this exception, the general mass of the cathedral is faultless, *i. e.* as the result of a conciliation between the architect's feeling for the Roman style, and his compelled obedience to the shape prescribed. With this consideration the grand building under notice must be judged. This it is which excuses the application of the upper order as a mere screen to conceal the clerestory and flying buttresses; for it must be admitted that uninterrupted altitude of the bulk, in the same plane, is absolutely necessary to the substructure of the majestic dome, which is indeed the very crown of England's architectural glory. The four projections which fill out the angles, formed by the intersecting lines of the cross, finely buttress up the mountain of masonry above; and the beautiful semicircular porticoes of the transepts still further carry out the sentiment of stability.

As to the dome in itself, it stands supreme on earth. The simple stylobate of its tambour; its uninterrupted peristyle, charmingly varied by occasionally solid intervening masonry, so artfully masking the buttress-work as to combine at once an appearance of elegant lightness with the visible means of confident security; all these, with each subsequently ascending feature of the composition, leave us to wonder how criticism can have ever spoken in qualified terms of Wren's artistic proficiency.

The Western front must be criticised as illustrating, in great measure, a Gothic idea Romanised. Instead of twin spires (as at Lichfield) we have two pyramidal piles of Italian detail; instead of the

high-pointed gable between, we have the classic pediment, as lofty as may be; the coupled columns and pilasters answer to the Gothic buttresses; and a minute richness and number of parts, with picturesque breaks in the entablatures, (though against the architect's expressed principles,) are introduced in compliance with the general aspect and vertical expression of the Gothic façade.

The exception to this is, of course, shewn wherever the entablatures continue their unbroken horizontality over insulated columns; as in the great portico of the West front, the porches of the transepts, and the peristyle of the dome. The architect has, however, well achieved the required compromise between two differing modes of design; and, as an harmonious amalgamation of the vertical and horizontal, the West front of St. Paul's is not only a success, but a triumph. The lower extended colonnade, and the upper part of the portico, contracted and pedimented, in their combination pyramidize, so as to prevent any feeling of excess either in height or width; and, whether we regard the towers from base to apex as distinct compositions, or as parts of the entire front, we recognise much beauty as well as ingenuity in the manner of their resolving themselves from a pure Roman beginning into a fanciful termination, not unsatisfactory even to the Gothic steeple-lover. There is, however, one aspect under which the entire building would exhibit a perfection, scarcely yet contemplated, save by an architect: such an aspect would be presented at about 3 p.m. on a fine, clear, and sunny day, if the complete pyramid of the structure, from the outer steps of the transept porticoes to the ball and cross, could be seen in direct front from Temple Bar. At that distance the Western towers, instead of encroaching slightly on the peristyle of the dome, would be detached from it; the transepts would be in an equal degree, but not injuriously, intruded on; while the West front would just gain the apparent increase desirable.

The floor plan of the church requires little comment. It exhibits no invention, for invention was forbidden. Excepting the projecting parts in the outer angles of the cross, where the transepts unite with the nave and choir, it has no arrangement not to be found in our old Gothic cathedrals. Even the absence of the four great piers, which usually support a central tower, has its Gothic precedent in Ely cathedral, where a lantern overhangs the great central octagon, just as the cupola in St. Paul's. We have, therefore, only to estimate the manner in which Wren has employed his Roman features and minor details, on a carcase presented to him, as it were, with no material permission of novelty; saving in the application of his circular vault, and lantern, of brick and stone, in lieu of the octagonal vault and lantern, of wood and of smaller dimension, at Ely.

It may be at once admitted that the nave, choir, and aisles, are, under all compulsory circumstances, unimprovable; though strict taste may regret some things those circumstances occasioned. The vaulting, however, over the nave and aisles, formed by flat domes on pendentives, is truly beautiful. The great cupola, in its expression of expanse with elevation, has no equal. That of the Pantheon at Rome gives expanse merely, as it is not higher than it is broad; that of St. Peter's is in height more than twice and one third its width, and we are therefore rather struck with its altitude than its horizontal capacity; that of St. Paul's is something less in height than twice its width, and, bearing also a much larger proportion to the rest of the building than in St. Peter's, it has much greater apparent size. The proportional altitude of the cupola of St. Gèneviève, at Paris, is still more than St. Peter's; that of the church of the Invalids something more than St. Paul's. The effect produced by Wren's cupola seems to indicate that its proportions are the best for producing, at the same moment, a sense of amplitude and loftiness combined.

The whispering gallery of St. Paul's, with all above it, leaves nothing, in the way of architectural form, to be desired; though there are many who think the character of painting adopted most injudicious. Below the gallery, however, criticism rests dissatisfied, if not offended; the four diagonal

sides of the octagon, beneath the tambour of the cupola, evincing an aim at more than the artist has successfully accomplished. To obtain an appearance of open lightness, developing the architecture and vaulting of the aisles behind them, these diagonal compartments are woefully cut up, and finished with ingenuity at the cost of judgment. It had been better if these four compartments had simply exhibited repetitions of what is practised in the nave, choir, and transepts, so far at least as was possible. There is no occasion for more than simple reference to defects which have ever been obvious to the critical eye. The confusion of these parts is positively so distressing, that alteration would be justifiable, only taking scrupulous care that it be effected by that "repetition" of Wren's own to which allusion has just been made. St. Peter's had many architects. The substitution of a better piece of Wren for another, in the same building, would not disturb the one-ness of itself or its designer.

The partial, but too apparent, defect just noticed, very probably grew out of the meddling obstinacy that insisted on the old cathedral form, but still it may not have been imperatively occasioned; for, in the cathedral of Ely no corresponding defect appears, and in the great church at Rome we feel no desire for other than the solidity of the four diagonal piers under the dome. In St. Paul's, however, as at Ely, there was space for diagonal openings answering to those of the nave, &c., and so far it was advantaged beyond St. Peter's; for, unquestionably, the means afforded by such openings for the uninterrupted perspective of the aisles from end to end of the entire interior are valuable.

If the architecture of Wren, as illustrated by St. Paul's, be judged with generous allowance for compulsory restriction, the result can be nothing less than deferential admiration.

And now a few words on the thoughtless cavils that have been raised on the subject of the double dome (we might as well say the triple dome) of St. Paul's.

The dome of the Pantheon at Rome, having nothing but itself to support, is a simple vault of masonry, so low in proportion, and so immensely buttressed, as to be prepared for an earthquake.

The dome of the Florentine cathedral is so highly pointed as to approximate towards the cone, and it is therefore the more fitted to bear the stone lantern at the top.

The dome of the Baptistery at Pisa is formed of a lofty internal cone, supporting the outer vault or hemispherical covering.

The non-appliance of constructive knowledge in the dome of St. Peter's at Rome was felt before it was finished. The lantern was made less than originally intended, but still it proved too heavy for the great vault that could hardly find safety for itself alone, and it has only been preserved to our wonder by hoops of iron; the means taken by Wren to secure the safety of Salisbury spire.

Our scientific architect had marked the failure of the Gothic architects in their deficient regard for lateral thrust. He had observed how fearful might be vertical pressure on a domical vault. Whether he was acquainted with the Florentine and Pisan examples we know not; but, if not, he had intuitively the knowledge they would have afforded him.

He had to place upon the top of his dome a stone lantern, with its ball and cross measuring some ninety feet in height. He therefore adopted the principle of the Pisan Baptistery. He constructed his inner brick cupola of the form and altitude he considered best for internal effect. Over this he built a cone, just free from pressing on his cupola, and he carried it upward till it met the required width for the base of his lantern; finishing his cone with a domed top, as at Pisa. This being determined, the attic story of his tambour arose to press down upon the common springing of cupola and cone; and, not to remedy a defect, but, "to make assurance double sure," he applied his hooping chains of iron. To protect the cone a roof was necessary, as that which covers the vaulting of his nave and aisles, and

of the same material, *i. e.* wood and lead; the purpose of protection and endurance being precisely the same in both cases. Apart from what Roman design requires—apart from the majesty of the hemispherical form,—is there a man breathing who would cover a circular cell and its cupola-vault with any thing but a hemispherical roof, as the best for affording the perpendicular weight of leaded timber upon the buttress of the cone, with means for effectively confining from bulging, either in or out, the masonry of that cone? The high Gothic dome of Florence is not admissible in pure Roman design; but a lantern, ponderous as that of Florence, is required. The simple hemispherical dome will not safely support such a lantern. The Pisan mode of construction suggests the mode of security. So much for mere construction.

Now for the matter of taste. Is there any reason for such scrupulous honesty, as shall shrink at the idea that the beholder may be deceived in thinking that the ceiling he sees within the building is the mere inside of the shell he sees without? May he not separately think of what is beautiful without and within; and contemplate distinctly the perfection of both, with a comfortable conscience as to the filling of the intervening space, especially when he knows that concealed work is necessary to his admiring in safety? If the spectator, amazed at the dignity of bulk and altitude without, gives to the expanse within the credit of equal size and altitude, is it not better than well? Is it not a fair illustration of the *ars est celare artem?* There is surely no need to be argumentative on this absurd question any longer. In every sense, artistic as well as scientific, the dome of St. Paul's (so far as the architect is concerned) is the transcendent example of perfection in its kind. Its cupola is the firmamental beauty of the cathedral's interior; its dome is the glory of its extern, and the fitting crown of the metropolis of England. It will be time enough to insist upon it that a church dome shall be simply an inverted cup of masonry, when all the remainder of the building shall have no roof but the vaulting which forms its ceiling.

It may be lastly said that the lead work of St. Paul's dome is eminently beautiful in the form of its ribbed or fluted decoration; and that the lantern with its iron gallery and gilded finial, have never been regarded but as deserving eulogy.

It is curious to observe that Wren, though opposed in his desire to avoid (as unsuitable) the general form of the Gothic cathedral, seems to have met with no antagonism in any remnant feeling for the Gothic style of detail. Neither his immediate patrons, nor the public, appear to have retained the least regard for it. Inigo Jones, who began under some degree of its influence, had so far rejected it as to affix a Corinthian portico to the old Gothic St. Paul's; and it is only unfortunate that any attachment to the ancient disposition of ground plan should have outlived all care for the old character of elevation. The Roman Catholic Duke of York, not having a word to say for the Gothic style of art, only insisted on the ichnographical arrangement suited to the imposing ceremonies of the worship he desired to restore; and the issue was disastrous, for it impeded the perfection of a modified classic development at the price of Gothic degradation. Not a word can be said in favour of Wren's Westminster Abbey Towers; but there is enough in his spire of St. Dunstan's, in the Tower of St. Michael's, Cornhill, and in the Bell Tower of Christ Church, Oxford, to shew that Wren's genius was "assailable" on the Gothic tack, had the wind of popular inclination at all served in that direction.

The estimate of Wren's architecture will be the more favourable, as our consideration is confined to his select works, or rather to certain works selected; nor will it argue an unfair partiality in our choice, if we put aside his buildings at Cambridge, his hospitals of Greenwich and Chelsea, with others of his public and all his private edifices; leaving, in addition to his design for St. Paul's, nothing more than the principal of his other London churches.

Now, if Wren had been the author of nothing more than the interior of St. Stephen's, Walbrook, his claims to architectural fame would have met with warm acknowledgment.

Let us at once admit the cupola-panelling to be improvable, and the springing of the diagonal arches across the rectangle formed by the entablature below, a liberty only justified on the plea, that without it we could not have had what we value as a beauty not to be spared. By the *complex-simplex* of the interior a charm is produced, rendering it perhaps the most triumphant *multum in parvo* to be found in Europe. The simple parallelogram of the plan resolves itself in its upward stages into two distinct cruciforms, till a cupola crowns the octagonal centre. Here we have the symbol of the Christian church, as the superstructure of a square ground floor; the space of which, as an auditorium, is interfered with to the least possible amount, by unstinted architectural sufficiency. The vertical proportions of the section are not less happily considered. Not grandeur, but the perfection of constructive lightness and Corinthian elegance is manifested in this Hall of the Sixteen (looking like Sixty) columns. Out of the precisions of geometry have here grown, apparently, the freedoms of natural grace; till the feeling and imagination of the artist are not less notable than his ingenuity and mechanical skill; and the entire result is an architectural gem of such form and quality, that it is only left us to wish the jewel were more worthily inclosed.

Of equal merit, in a different way, is another interior, like the former, simply inclosed in a mere box of brick and stone—the church of St. James Piccadilly. Here is less playfulness of fancy, because the occasion admitted not so much, or at least required it not; the demand for galleries altering the conditions under which an architectural character was to be given; but take it with those conditions, and the church in Piccadilly is as decidedly a masterpiece as that in Walbrook. The way in which a maximum of space in every direction is obtained, with a minimum of filling, is admirable. Being done, the extreme simplicity of the result looks like the mere obvious production of common sense; and it requires some consideration to estimate the power of ready invention, that lies concealed under an aspect so little denoting any extraordinary exercise of ingenuity. In the church of St. James especially, a free, noble, and elegant piece of art, has derived itself from a sound, economic, and scientific process of construction. The carpenter here co-operates with the artist in the production of a model, wherein commodiousness and beauty were perhaps never before so felicitously combined. The roof is unimprovable, and the superficial work, that internally cases it, is as the outer grace of the human form, which attests the skeleton's perfection.

It is, after all that has been done or argued by Classic or Goth, a question whether St. James' Church, Piccadilly, does not present the most perfect model of a Protestant Church-interior in existence. Wren's observation had led him to the conclusion, that no more than two thousand persons could be accommodated in a single room, with pews and galleries, so that all might distinctly see and hear the speaker. In this church he "endeavoured" to provide for such a number, in a manner consonant with architectural dignity and beauty. That he failed not in his "endeavour," will be allowed by every one, who first considers the architect's intention and the building's purpose; and then contemplates the artistic way in which both have been fulfilled.

In the church of St. Bride, Fleet Street, we have much more external pretension than in those of Walbrook and Piccadilly, while the interior exhibits a character distinct from either. An equal aptitude to every variety of form, with a perfectly new spring of invention, is observable in every fresh call upon the architect's genius. Though St. Bride's interior (saving only in length) is inferior in magnitude to St. James', it is of more complex character; partaking, in the disposition of its parts, of the old cathedral choir, the arcades being surmounted by clerestory ranges, and the ceiling of the aisles groined after the old fashion. The coupling of the columns under the arches, and their clustering with those which support

the galleries, are free imitations of the Gothic compound pillars; and we may regard this example as having been probably influenced by the wishes of the then "high church" party, who retained a partiality for the clerestory. Wren was the originator of much that others have since imitated; and if it be said that he had also received many suggestions from elder artists, let us call for recent examples to shew the same improving use of Wren that he exhibited in the use of his predecessors.

The steeple of St. Bride's Church *alone* does not assert the strength of his genius, nor the play of his fancy, so much as his judgment and taste, in producing an elegant arrangement of simple and resembling geometrical forms, within an outline of unimprovable grace. In certain other examples, we observe the free pencil of the artist tracing fluent lines of beauty; in this, we see how the rule and compasses of the geometrician have rather been in operation, though to a result leaving us to wish for nothing else in its stead. The gradual increase of open-work and decoration, in the ascent of its elevation from the base to the crowning obelisk, is charmingly effected; and, though this spire, like a Chinese pagoda, is little else than a repetition of octagonal chambers successively diminishing in their rise still the retention of their vertical lines, in concentric progression, so far unites them into an unbroken whole, as to correct the objection which might be (critically) taken to a pile of distinct (though resembling) parts. Let us grant Wren has here aimed at what can only be thoroughly perfected in a Gothic spire; it is enough, the beauty accomplished is proved compatible with Italian detail. There is, moreover, this to be said of the Italian steeple, that it admits of a distinct variety peculiar to itself; *i. e.* not only a difference but a distinction, as marked as in things of separate kinds. Even when the general outlines of two Italian spires may much resemble each other, this distinction may be preserved, so as to "tell" no less in a distant than in a near view; and the advantage of this (pictorially speaking) in a city of many spires, must be obvious—to the painter's eye at least.

The steeple of Bow Church, Cheapside, is little short of perfection, as an adaptation of classic detail to a general form, whose vital principle is that continuous verticality which can only be fully carried out in the Pointed style; and it may be truly affirmed, that this principle is displayed with more completeness in the spire of St. Mary-le-Bow, than in many Gothic examples of distinguished celebrity, wherein we see a connexion of tower and spire, without that combination which, by artistic management, renders the united two a single entirety. Where a steeple has more than one great part, the graduation necessary to complex beauty, requires at least three components; and, as in the case of Bow Church, it will be better to have four or five. As in other of Wren's works, the graces of this steeple grow out of, and, as with natural luxuriance, overspread the form perfected by constructive science. The section shows why the elevation is what it is; and the successive plans of each story as truthfully superimpose one above the other, as the ascending parts of the human frame. Not a feature is eccentric: each stage rises from out of its inferior and into its superior, as thought from and thought in the eloquence of a perfect orator. It is true the whole may be taken to pieces; *i. e.* the pieces are separable; but no portion has, distinctively, one fiftieth part the beauty of the five collectively,—the basement, the bell-chamber, the circular peristyle, the rectangular composition next above, and the crowning obelisk. These, in their individual and relative forms and proportions, are the felicitous results of as many fresh thoughts co-operating in the development of one idea.

Though Wren's Pointed architecture cannot (either critically or opprobiously) be called Gothic, we may yet refer to three or four examples having, in their nondescript character, a merit of their own. There is a picturesqueness in the bulk and form of the bell tower of Christ Church College, Oxford, which we should be loth to change for anything more justified by Gothic precedent; and, in the tower of St. Michael's, Cornhill, we recognise a successful aim at effectiveness, and a feeling for masculine beauty, which are scarcely the less noticeable because expressed in very indifferent grammar or uncertain language; but it is to the steeple of St. Dunstan's in the East that we would especially

allude as an example of supreme grace. In the bodily form of its combined features little improvement can be suggested. Supplant the little cappings above the flying buttresses by small pinnacles; apply engaged pinnacles where the square diagonal buttresses of the tower resolve themselves into the angle octagons; then Gothicise the square panellings of the minor horizontal compartments of the tower, and the old example of St. Nicholas, at Newcastle, will be the more favoured by non-comparison; for, even as it is, the venerable "legitimate" would shew but indifferently beside his bastard successor.

In St. Dunstan's, as in the steeple of St. Mary-le-bow, beauty is the result of taste operating on constructive perfection; nor has the former example any existing rival in simple and elegant delicacy, combined with such an expression of enduring strength. Considered Gothically, this beautiful design has (as we have seen) some minor defects, which, however, as Gothic feeling pervades, are injuriously important. Let but the true Gothic artist, by the minimum of required excision and addition, correct these defects, and we should probably have an example of what Wren would have done as a Goth of our present day. The circumstances of particular times will influence the mode in which genius displays itself; but whatever be the mode, the display should be obvious; and we can only lament the bluntness of the perception which cannot pierce through a partially defective manner, to rest with due admiration on the material excellence that nevertheless exists.

It has been the purpose of this essay, first, to shew that Sir Christopher Wren was a man of *genius* in the full sense of the word, namely, that talent which would have rendered his name famous though he had achieved no architectural celebrity whatever. Secondly, to do justice to the *man*, by considering his architecture under all the circumstances of its production; his lack of especial preparatory study; the sudden call upon him for so vast an amount of occupation, with its ever-attendant responsibilities, and its too frequent mortifying vexations, particularly in the case of the one great building, which is, therefore, the monument of his skill under difficulties, but not the just representative of his unshackled artist feeling. Thirdly, to do justice to his *architecture*, without reference to any consideration but that of the unchanging principles on which everything in art that is lasting (and therefore true) is philosophically founded.

It is admitted that Wren's fame as an architect would not be exalted by a strictly critical estimate of all the buildings not particularised in the foregoing pages; though there be some, and parts of others, which have merit balancing the absence of it in the rest. But the examples we have noticed sufficiently attest his power on great occasions, the mastery by which he gave importance to those of less import, and the ingenuity with which he made artistic taste and feeling combine with science in certain others which exhibit more especial originality.

Had we an account of all the circumstances attending the erection of each building, we should probably have rather to sympathise with the architect's vexations than to arraign his taste; but Wren thought too modestly of his own works and too humbly of himself, to care for more than the exercise of his best efforts, under the favourable or unfavourable auspices affecting them; content to abide, without any defensive explanations on his part, the judgment which discriminating criticism would pass on his works as a whole.

Doubtless the genius of this great architect was influenced by the moral goodness of his character, by its philosophic gravity, and, more than all, by its religious equanimity; nor can we but delight in thinking upon Christopher Wren as the supreme exemplar of the Vitruvian model; worthy, in every sense, of his own self-erected mausoleum, and of the noble epitaph by which his son confirmed its dedication.

Want of space prevents this Essay being printed in extenso.

ON THE GENERAL THEORY OF PROPORTION IN ARCHITECTURAL DESIGN AND ITS EXEMPLIFICATION IN DETAIL IN THE PARTHENON.

By W. Watkiss Lloyd, Esq. Read at the Royal Institute of British Architects, June 13th, 1859.

I have undertaken this evening to render an account of the results of some studies of the principles of proportion in architecture, as exemplified in the Parthenon.

The subject is not proposed as one of mere archæological interest, or simply as a curious chapter from the history of the art; if justice can be done to it, it ought to be something more—it ought to be a contribution to the scientific aids and resources of the art, as proving not merely that the Greeks worked upon such and such arbitrary maxims, but that they had discovered certain principles. To trace a theory of proportion as employed by the Greeks in design may be of interest in any case, but how much the more should it approve itself as having a rational and scientific basis.

Few here, it is probable, will doubt that the solution of one of these problems involves that of the other; and whoever can prove that he holds the explanation of the proportions of the Parthenon, will be easily absolved from further argument that the system employed was right and truly scientific: as on the other hand a claim to possess a true theory would have to stand the test of application to the Parthenon. The general theme of admiration of all who write and all who speak of the impression of this temple on the spectator, I have found to be the sense of harmony that it excites—the pleasureable satisfaction of the feelings associated with proportion; grace of proportion, dignity of proportion, justness and harmony of proportion, are phrases that recur in the course of their observations again and again. In response to what is implied in these expressions, the speculative have not been remiss in asserting for architectural harmony as close a dependence on mathematics as has been so long established for musical. Admitting the justness of the presumption so far, I may say at once that my own conclusions are quite at variance with what is often the next presumption, that the ratios of the diatonic scale have any special value as realized in architectural forms. I do not find this to be the case; I venture to say I find it distinctly not to be the case, but inasmuch as wherever numerous proportions are applied, on whatever principle, those which are found in the musical scale are sure to occur along with others, I can quite understand how the coincidences encourage a prepossessed or precipitate theorist and flatter to betray.

It will be convenient to state succinctly in the first instance the most important conclusions, which will then be easily borne in mind through the process of proof and application.

First; it has appeared that the Greek architect attached the highest importance to the determination of his dimensions by proportion, and to the execution of those dimensions with minute exactness. Accidents and faults apart, for which a margin must be always allowed, nothing was left to chance, random, or remainder.

Secondly; dimensions are proportional, in the customary sense of the word, when they have a common measure; but it becomes of importance to decide in what directions they are most appropriately taken, which lines are architecturally characteristic. I find that the Greek architects brought into comparison dimensions measured along the same straight lines, or lines parallel, and such a comparison for convenience I call Rectilinear proportion; thus the height of an entablature may be commensurable with the height of a column, the breadth of a metope with the breadth of a triglyph, the height of a naos door with the height of a pronaos column. Another important form of comparison is between dimensions taken at right angles to each other, and such instances will be referred to as

Rectangular proportions. Thus it seems obvious and reasonable to estimate the proportion of an oblong plan by comparative statement of the length and breadth; no doubt its form might be recorded and communicated numerically by the statement of the angle of its diagonal with a side; but the eye does not judge such a proportion by reference to the diagonal.

The comparison of length and breadth of the temple measured upon the top step, of the height and length of an apartment, of the height and breadth of the façade, or a triglyph, &c., are examples of rectangular proportion.

The direct comparison of areas I only meet with in one, but that a very important class of instances; I refer to the determination of the relative proportion of columns by proportion of their sectional area, a subject which space forbids me to enter upon.

Assuming it to be determined that no dimension shall be admitted into a design that shall not be proportionate to some other dimension, either rectilinearly, rectangularly, or both ways, it still remains to be considered what proportions or what ratios, (using an equivalent expression), shall be adopted. Ratios even of low numbers exclusively, offer themselves in crowds, and are to be subjected to arrangement and selection. If we commence with two equal lines and leaving one unaltered, alter the other by continuous diminutions, we shall find every conceivable or possible ratio occurring between absolute equality, 1 : 1 on the one hand, and absolute disparity 1 : 0 on the other. If we pause at certain stages of the progress, as determined by some principle, these resting places will form a scale of proportion, a series of steps by which we may regulate degree of approach to and departure from equality between any compared dimensions or series of dimensions. On what principles are the resting places to be determined, the scales constructed? I can only give results briefly and partially too.

First; the design itself will necessitate the adoption of certain ratios from the requirements of purpose and plan.

Secondly; the variety of exigencies demand that the other selected ratios should range pretty widely over the interval to be divided, and give a choice of proportions verging towards inequality as well as towards equality, yet with sufficient interval to preclude confusing proximity.

Without pursuing the analysis further now, I must content myself with stating that the scale by which the Parthenon is regulated, commencing with the ratio 1 : 6, advances towards equality by ratios preserving the common difference between their terms of 5. Thus, 1 : 6, 2 : 7, 3 : 8, 4 : 9, 5 : 10, &c. As the scheme advances the differences become trifling, and the numbers undesirably high, and the scale is made out by the ratios 4 : 5, 5 : 6, 6 : 7, &c. the common members of a primary series. Such a scale is formed by the rejection of the innumerable other ratios, some self-condemned by their high numbers, but others as not required or as interfering with the effect of the most characteristic ratios. Thus, the ratios 1 : 3 and 2 : 5, are most extensively and importantly employed in the temple at Bassæ, but are absolutely unknown in the Parthenon. Even of the members of the scale admissible and admitted some are comparatively neglected, while emphasis is given to a few by repetition in many instances, and both rectilinearly and rectangularly, and in applications expressive and important. Such predominance we shall find to be given in the Parthenon to the ratios 4 : 9, 7 : 12 and 9 : 14,—to the first especially. It is to be assumed that the system of making dimensions proportionate to each other, sometimes rectilinearly and sometimes rectangularly was adopted on the principle that the mind and eye naturally take cognizance of both forms of comparison, and feel satisfaction in both harmonies. What then, it may be said, are their comparative values when they clash? It was the aim and study of the Greek architect of the Parthenon that they should not clash, and we shall have to admire the dexterity and success with which he harmonized the two forms of comparison, so that

rectilinear proportions that fall out as happily as if they had been exclusively considered, are found to be compatible with, indeed to be the means of bringing about, rectangular comparisons that are still more effective; but I leave it for the examples to bring home the value of this principle, and the skill evinced in employing it.

To the examples again I must trust for conveying due appreciation of the strict and logical consistency with which the Greek architect selected the terms of his comparisons; that the length of an apartment should be brought into proportion to its breadth, may be obvious enough, but in the ramification of design divisions are called for which must not be proportioned at random, but can only be correctly referred by a shrewd eye for correlative function and expression. Proportions to be expressive must correspond with and so represent natural relations of analogy or antithesis, and it was in the discernment or contrivance of these that Genius founded and perfected Greek architecture.

The terms to which a prerogative importance is allowed in regulating other dimensions, are especially,

1. The breadth of the front, from which is derived,
2. The breadth of the abacus, and
3. The lower diameter of the column.

But no subdivision of these into any moderate number of fixed minutes or modules, will explain their regulating power, which is dependent upon variable proportion, upon the adoption of ratios that may be taken from any part of the scale.

The designer of a Greek temple held it of importance to secure a definite proportion of low numbers between the length and breadth of the structure. as taken upon the grand stylobate, whether upon the topmost or on a lower step; a horizontal rectangular proportion. Thus the Parthenon has breadth and length on top step as 4 : 9, the Theseum the same but on the lower step, and the temple at Bassæ also on lower step has the proportion of 2 : 5, and the temple at Ægina that of a double square.

Equally important, or even more so was it that the full vertical height of the front, from the pavement of the peribolus to the apex of the pediment, should compare in a ratio of low numbers. In several hexastyle temples, those of Theseus and Bassæ are examples, and, I may add, the Western front of the Propylæa, the height of the front is commensurate with the breadth, as 3 : 4. In the Parthenon we shall find that, besides this grand ratio of height and breadth, which there is 9 : 14, very accurate rectangular proportions were obtained between other main divisions of the elevation: the check upon multiplying these in every instance, was the stringent importance of certain rectilinear proportions which were liable to interfere with them. Of these it appears from comparison of examples, that the greatest importance was attached to making the height of the column exceed the joint height of the other members, that is, stylobate, entablature, and pediment, by a single aliquot. For example, the height of the column may compare with the complementary height of the front as 7 : 6, or as 6 : 5, &c. &c. In other words, the height of the column as compared with complement of height is the larger term in, what is technically called a super-particular ratio. The ratio applied in the Parthenon is 10 : 9; in the Theseum 5 : 4, equivalent to 10 : 8. The Sicilian builders never discovered or appreciated this principle, and their effects suffer accordingly.

Thus much for the elevation of the front, but a farther arrangement was thought necessary or desirable in the Parthenon, in order to harmonize the column as vertical member with the joint horizontals, entablature, and stylobate, as seen on flank, where from such frequented points of view the height of the roof was not visible or brought into comparison. Accordingly the joint height of the stylobate and entablature on the flank s just equal to half the height of the column; or say, height of column: complement on flank, :: 2 : 1. With what exactness this is the case will appear from the comparison

of figures to be given presently. The same ratio holds good in the same comparison in the Theseum, where the entablature received an addition of height from the cymatium, which, as discovered by Mr. Penrose, was returned along its entire length.

It was a further established principle that the height of the column should compare symmetrically with the horizontal spacing of the columns; should, in fact, be just equal to the dimensions from the centre or edge of one column to the centre or edge of a third, measured upon the plan. In the Parthenon this symmetry is applied to three ordinary columns and the two intercolumns included, and the same appears to be the case at Sunium. In the east front of the Propylæa and in the temple at Bassæ an angle column and columniation are included in the comparison, which, in the latter case at least, introduces a difference from the relative contraction of the angle columniation. In the temple at Rhamnus the dimension is taken from the outer edge of the angle column to the centre of the third from the angle; in the Theseum we have a like division, but involving only ordinary columns.

I apprehend that the introduction of these equalities of heights with breadths was found to give repose to the effect of a long range of columns, as a repetition of similar spaces and dimensions, and the principle may be susceptible of wide application, as in fenestrated compositions. If in the progress of a design we conceive the diameter and spacing of the columns to be settled in the first instance, it is clear that the principle just stated would limit the architect to choice of height among three or four fixed dimensions, and, on the other hand, if the height of the column is assumed, the systems of spacing that are available would be reduced within narrow limits. In point of fact, in all such cases, no one point was settled absolutely until all others were settled. When the result is obtained it appears as if the adoption of one harmony brings about another as a necessary consequence, but this is not an accident, for the decision to adopt the first was made on the very ground that it was compatible with or involved a second; in all such adjustments the search is for those symmetries and proportions which recommend themselves by bringing the richest dower of subsidiary harmonies conducive to the effect required, and no solution is satisfactory until such are found.

One more principle, much taken to heart by the architects of the Doric temples of Greece proper, was to adopt a breadth for the abacus of the capital equal to $\frac{1}{5}$ of the height of the column, or else an aliquot part of the breadth of the temple on the top step, or lastly accommodating both conditions. A dimension for this part, however, cannot be adopted lightly, for it decides the diameter of the echinus at its greatest swell, and this must be relative to the general proportions required for the column. At Bassæ the abacus of the front is $\frac{1}{5}$ of the height of the column, but not commensurable with the top step; in the Theseum it is $\frac{1}{5}$ of the height of the column, and also $\frac{1}{12}$ of the top step; in the Parthenon the ordinary abacus of the east front is $\frac{1}{15}$ of the top step, but not commensurable with the height of the column; the abacus of an angle column, however, which is broader than the ordinary, is equal in breadth to $\frac{1}{5}$ of the height of the column, while on the other hand it is, of course, no aliquot of the top step.

Such were the leading conditions to which by custom of the style, by experience of good effect, or by manifest fitness, the architect's design was bound to conform, which gave a certain guidance at the same time that they gave a certain control; not so much guidance that responsibility for ultimate effect did not rest with his genius, not so much control that genius had not ample range for variety and invention.

We have now therefore, in the case of the Parthenon, a clear breadth of front of 100 Attic feet, say 101·341, on which to erect an octastyle Doric portico, with diameters of columns proportioned to intercolumns in about the ratio 4 : 5, and in the distribution of the eight columns we have to take into account that, in accordance with the style, the angle columns are to have a somewhat larger

diameter, and the angle intercolumns are to be somewhat more contracted than the rest. The process by which, it appears to me, the architect made the distribution in the present instance, is as follows:—The top step had to be divided into seven main segments, five of them being equal, and giving the lines of centres for six columns equidistant from each other, while the two end segments were to be somewhat larger, in order to receive the full diameters of the angle columns, a difference that more than makes up for the contraction of the angle intercolumniation. The problem therefore, in the first instance, is to assign the degree of excess to the two angle segments, as the breadth of the front divided by seven, after deduction of this joint excess, would give columniation. The seven segments of the step correspond to seven segments of the architrave, each equal, in a general way, to the breadth of two triglyphs and two metopes, except the external segments, which have to accommodate an additional half triglyph. Now, if we deduct the breadth of a semi-triglyph from each end of the step, and divide the intermediate space by seven, we shall find the divisions give us the ordinary columniations with the greatest accuracy. This process, of course, assumes that we know the breadth of the triglyph, and this may easily have been obtained before the average columniation was absolutely settled, as it is deducible proportionably from the breadth of the architrave.

Triglyph.		Columniation.	Ang. Seg.		Measured.
101·341 − 2·786	= 98·555 ÷ 7	= 14·079	+ 1·393	= 15·472	Cf. 15·478, 15·367,
228·141 − "	= 225·355 ÷ 16	= 14·084	+ "	= 15·477	15·468, 15·449, 15·531, 15·443.

We have now therefore obtained the centres of the columns, giving columniation 14·084, which is exactly coincident with a great many as measured, and also with the average of the variations, the principle of which is accurately determinable, but cannot be now discussed. If we divide this calculated columniation into nine parts, and assign four to the diameter and five to the intercolumn, we obtain, $14{\cdot}084 \div 9 = 1{\cdot}565 \times 5 = 7{\cdot}825$, intercolumn; $14{\cdot}084 \div 9 = 1{\cdot}565 \times 4 = 6{\cdot}260$, diameter. The measured diameters give 6.250 and even 6·245, and this may be held a sufficient approximation; still I believe that another principle decided the exact dimension adopted, though the difference may be but little more than the $\frac{1}{8}$ of an inch. Again we are entitled, by the usage of the order to look out for an agreement between the height of the column and a division of the colonnade on plan. The nearest approximation is given by the dimension on plan that includes three diameters and two ordinary intercolumns, viz., 34·428, but the height of the column is only 34·250, giving a difference of full two inches. Here again, while we are bound to admit that this approximate symmetry was regarded and valued, it is clear that we cannot accept it as governing the dimensions adopted in execution for the height of columns.

I will first go over the scheme of proportions by which I conceive this and the other divisions of the elevation to have been decided, and afterwards give the comparative tabulation of the dimensions as they come out by calculation, and as set down in the measurements of Mr. Penrose.

The proportion of the height of the front to the breadth of the top step is as 9 : 14. The breadth of the front is to the length of the temple as 4 : 9, as we have seen; and it is a necessary consequence of these proportions that the height of the front should compare with the length of the temple as 2 : 7. These therefore are the grand circumscribing proportions of the structure; the only inaccuracy is that the measured height of the front is $\frac{1}{2}$ an inch higher than it should be by calculation; but the actual length of the temple compares with the height thus enhanced in the ratio 2 : 7, with absolute exactness within $\frac{6}{1000}$ of a foot.

2 : 65·1815 :: 7 : 228·147 Cf. measured 228.141.

It will be observed that the ratios, 2 : 7, 4 : 9, and 9 : 14, have respectively the common

difference between their terms, of 5. In the recited order the terms approach towards equality, and the series may be extended by insertion of intermediate and other ratios having the same characteristic, thus— 1 : 6, 2 : 7, 3 : 8, 4 : 9, 5 : 10, &c.

It will be found that several of these ratios as repeated with marked intention in the Parthenon, while none whatever are employed in the design that do not belong to the series either directly or as equivalents (as 2 : 3=10 : 15, &c.) The height of the front thus obtained is divided between height of column and of complement in the ratio 10 : 9, which gives 34·288 for the column, to compare with 34·250, the height of the angle column. From the complementary height we have now to deduct a dimension equal to half the height of the column, viz., 17·125, to be distributed between the stylobate and the entablature, so that the height of the column shall be just $\frac{2}{3}$ of the height from the level of the peribolus to the base of the antefixal ornaments on flank. The remainder of the complementary height belongs to the pediment, and proves just equal to the breadth of the ordinary columniation.

It will be observed, that it still remains to complete the horizontal division of the front by apportionment of dimension between entablature and stylobate. The problem may be stated to make such an apportionment that the rectilinear proportion adopted shall also bring about or be consistent with a certain number of very important rectangular proportions. On general considerations it may be easily determined to give a larger share of the dimensions at command to the entablature; but the question still remains, how much more? How much more precisely, and why? In effect the apportionment was made by giving 6 parts in height to the stylobate as against 11 to the entablature; the ratio 6 : 11, it will be observed, belongs to the series already specified.

The rectangular proportions conciliated by such division are these:—The joint height of column and entablature comes out exactly commensurable with the hundred Attic feet in the breadth of front in the ratio 4 : 9, which is the proportion of the plan; consequently, as the length of the top step is to its breadth so is that breadth to the joint height of column and entablature.

Again, by the dimensions assigned by calculation, the breadth of the top step is commensurable with the joint height of column, entablature, and pediment as 12 : 7 nearly; by the addition,—by the adjusting increment, of half an inch to the pediment the comparison becomes exact, with the further advantage of making the height of the pediment equal to one columniation.

Let us now compare the tabulated dimensions as furnished by Mr. Penrose's independent and scrupulous measurements which are accessible to all, and as deducible by the process I have set forth.

Hecatompedon.			Calculated.	Measured.
101·341 : 14 ::	9 :	65·1478	Full height of Front	65·185
30·859 : 9 ::	10 :	34·288	height of angle column	34·253
34·288 : 10 ::	9 :	30·859	complement of front	30·932

65·147 full height as calculated above.

Ht. of Column.

34·288 : 2 :: 1 : 17·144 stylobate + entablature ..... 17·150 on flank.

11·093 : 11 :: 6 : 6·050 height of stylobate ..... 6·058

6·050 : 6 :: 11 : 11·093 entablature on flank ..... } 11·092
i.e. + returned fillet of cymatium ..... }

17·143 joint stylobate and entablature as above,

From calculated height of front		65·147	
Deduct calculated entablature ...	11·093		
„ „ column.....	34·288		
„ „ stylobate	6·050	51·431	
Remainder for pediment		13·716	
Add height of fillet of cymatium only included in entablature on flank.....		0·299	
Add increment, as referred to above		0·037	
		14·052	height of pediment 14·073
Entablature on front, calculated.....		10·794	
Column, calculated		34·288	
Height from pavement to apex, calculated.....		59·134	
101·341 : 12 :: 7 :		59·115	Cf. measured ..... 59·127

101·341 : 9 :: 4 : 45·0426 column + entablature on front..... do. ..... 45·046

With respect to the vertical division of the entablature, the frieze and architrave are made equal within a minute difference which is given in favour of the architrave, and scarcely amounts to $\frac{1}{8}$ of an inch. The thickness of the horizontal cornice on front is derived from the height of the frieze by the ratio 4 : 9. It is therefore easy to divide the height of the entablature by 22, and assign 4 parts to cornice and 9 each to architrave and frieze.

Frieze 4·417 : 9 :: 4 : 1·963 Cf. measured 1·951.

The perpendicular thickness of the raking cornice, with its cymatium at the apex of the pediment, is derived from the horizontal cornice, to which it is proportioned as 4 : 3.

I may add here, that the height of the capital is derived from the diameter of the angle column by the ratio 4 : 9 viz. 9 : 4 :: 6·378 : 2·834 to compare with measured 2·833. Again, the breadth of the triglyph is derived by the same ratio from the lower diameter of the ordinary column, viz., 9 : 4 :: 6·250 : 2·777. Compare measured 2·766.

The height of the stylobate is determined by the proportions of the elevation, but it still remains to assign a projection for its lowest step. The projection assigned, the joint breadth of the three lower steps is 4·997 which brings the following relations into harmony :—

5 : 4 :: diam. of ordinary col. 6·250 : 5·00 (measured 4·997).

Thus, the intercolumn is to diameter as diameter is to projection of steps,

6 : 5 :: 6·058 height of stylobate : 5·048 projection (4·997).

We cannot too highly appreciate the force and vigour that the composition gains by the feeling with which the artist has tempered the horizontality of the steps by the predominance of verticality in their profile. It is by the thickness of the stylobate exceeding its projection in the ratio of 6 : 5, while that of the column falls below the breadth of its correlative, the intercolumn, in the ratio 4 : 5, that it acquires an expression of superior solidity corresponding to its function of bearing the columns, though in reality of smaller dimension than a diameter. The effect is assisted and enhanced by the

steepness of the top step, the proper stylobate, as compared with those below. The height assigned to it seems to have been derived from the diameter of the angle column by the normal ratio 2 : 7, viz.

7 : 2 :: 6·378 diam. of angle col. : 1·822 height of top step (1·814 measured).

We must now proceed to an abstract of the considerations of proportion which seem to have governed the distribution of the plan between peristyle, cella, and divisions of cella. The primary concern is to determine the line of the upper step, or proper basement of the cella, relatively to the parallel line of the upper step of the grand peristyle. The anta is placed at such a distance from the edge of the stylobate, that the sum of its breadth and the interval between it and a flank column exactly equals a columniation. To state this differently, the dimension including diameter of column on flank of anta, and interval between them, exactly equals the sum of the diameters of two adjacent columns on flank and the interval between them ; and inasmuch as the anta is less in diameter than a column the difference goes to enhance the interval or void. The process of division is, therefore, the simplest conceivable. Set off on the front from angle of top step a dimension equal to an ordinary columniation plus an ordinary diameter, say 20·34 ; this gives the lateral distance for the inner angle of the anta ; assign a breadth to the anta which has a ratio to the diameter of column as 4 : 5, and this gives the outer angle of the anta, and the line of the cella step on flank.

The next, and a most important consideration, is the extent of the top step of the cella East and West ; its distance from the parallel line of stylobate on either front. Here we find that by continued gradation, the interval between step of cella and edge of top step of grand stylobate is made greater on front than on flank, exceeds it in fact at the East front in the ratio of 8 : 7, being the exact ratio in which the interval from cella wall to flank column exceeds the intercolumn,

(viz. 8 : 8·920 :: 7 : 7.805 measured 7·818, &c.). 8 : 7 :: 17·138 : 14·997, measured 15·00.

The artist, however, who decided these proportions had regard at the same time to their compatibility with some others that are of the highest importance ; the cella which was to be distributed among apartments that were required to have definite proportions could not have its length relatively to its breadth determined at random. Measured on the top step it has very exactly a ratio of breadth to length as 7 : 19 ; thus, 7 : 71·33 :: 19 : 193·61 which varies from measured length 193·733 on by deficiency of ·123, and this difference seems to be but the reappearance of the error 0·125 that we have noticed in length of the grand stylobate, from just ratio to its breadth. The ratio 7 : 19 seems at first sight unhandsome and undesirable, from the high number it includes, and the great difference between its terms ; indeed had the architect made the lower step of the cella longer by 0·68, it would have had the desirable proportion of 3 : 8, the change, however, involving a sacrifice of graces which he did not allow himself to be tempted to make. His justification and purpose became readily apparent. If we deduct an exact square from an oblong 7 : 19, we are manifestly left with an oblong reduced to the ratio 7 : 12, and this is the division which has been adopted. The breadth of the cella 71·33 is just equal to the dimension from the top step of the posticum to the back of the opisthodomus, including the thickness of the transverse wall of partition (71·334), and consequently the same breadth compared with the remainder of length, the dimension from the transverse wall in the naos to the edge of the pronaos step necessarily bears to it the ratio 7 : 12, the same ratio that occupies so important a place in the elevation of the façade.

I believe it to have been in order to help the value of this proportion, that the pavements of the naos and pronaos were made almost exactly upon a level, and thus, when the portal was thrown open, the spectator might easily take both dimensions together within the scope of vision.

From the stringency of the general proportions applied in the opisthodomus it is clear that we must expect at least equal care in the more important naos; it is also clear that whatever difficulties may have occurred in distributing the naos, they were overcome not by sacrificing the proportions of the opisthodomus but by effectually reconciling them. But by this distribution, the plan of the proper opisthodomus itself is brought out with depth and breadth very accurately proportioned, as 11 : 16. The clear interior breadth, on level of the pavement, is 62·570 (viz. 4·380×2=8·760+62·570=71·330) and the corresponding depth, as shown on plan, is 43·003. Now, 16 : 11 :: 62·570 : 43·016, a result which may be considered absolutely identical.

The uncertainty that exists, from the condition of the ruins, as to the height originally assigned by the architect to the interior of the naos and of the opisthodomus, hampers our investigation of the considerations by which he decided the distribution of the plan.

I have shown that the architect divided the platform of his cella by a transverse line, which gave an exact square for partition wall, opisthodomus, and posticum, and an oblong of the proportion 7 : 12 for the naos and pronaos. Assuming the thickness of the flank walls to be determined, the clear interior breadth of the apartments is given, and it remains to place the walls of the door jambs, on either front, at such distances from the wall of partition as to afford plans for the apartments of desirable proportions, and also leave fitting remainders for pronaos and posticum. Accordingly, the pronaos wall is so placed as to make the length of the naos 98·095, which compares with the sheer breadth from wall to wall of 63.01, in ratio 14 : 9. That is to say, the ichnography of the grand apartment,—of the naos, has precisely the same ratio between its dimensions, taken rectangularly, that obtains between the breadth of the temple and its full height on front from pavement of peribolus to apex of pediment.

14 : 9 :: 98·095 : 63·06 (measured 63·01).

This is the third example of a repetition of a special proportion, rectangularly on plan and on elevation, and in positions corresponding in relative importance; the former being 7 : 12, and 4 : 9. The thickness given to the pronaos wall equals the breadth of an abacus, and it happily results that the dimensions from the pronaos wall to the line of lowest step on front, is exactly double that from the edge of cella step to the same line of the stylobate returned on flank.

It seems to have been a traditional principle that the hecatompedon, or 100 feet, which, as we have seen, measures the breadth of the temple, should also apply to some manifest dimension of the naos. To the naos specifically the title Hecatompedæan is found ascribed in inscriptions, and we need not look far to find a coincidence as near as the nature of the case would require. The dimension from the back wall of the naos to the centre line of the threshold measures 101·470, to compare with the exact estimate of 101·341.

I have now reached or rather exceeded the limits allowable for a paper. I am bound to observe that it is due to these limits that I have only been able to exemplify the theory by a selection of instances, and that there is not one application of proportion adduced that I cannot support by conclusive parallels in other Greek works. Although it is only in the Parthenon that all the refinements of the system are employed in all their perfection, yet each appears elsewhere separately, and so distinctly as to leave no doubt as to its recognition. These corroborations, therefore, I have been obliged to pretermit, for the same reason that I have avoided discussing rival systems, and the examination of the extent to which they involve truth, and the points at which, as it seems to me, fallacy supervenes.

PAPERS

READ AT

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SESSION 1859-60.

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OPENING MEETING, held at the New Rooms, No. 9, Conduit Street, Hanover Square, 7th November, 1859.

The President, Earl de Grey, expressed the pride and pleasure which he felt in presiding over the Institute for the first time in a place where he might honestly say they had a *locus standi*. For many years past they had met in different places, but with the liability of being turned out at any time with very little notice; and nothing but the general good will and good feeling of the Members, and their anxiety to cultivate the interests of the profession, had enabled them to go on so long. Last year, however, an opportunity had offered of securing better premises, and he had the greatest pleasure in inaugurating the opening of them on this occasion. The Architectural Union Company, to which they were partly indebted for the possession of these premises, was a very useful and valuable Society, but although the Institute was their tenant, it was nevertheless perfectly independent of that body. The two Societies had a community of interests, and under the arrangements which had been made, the Institute had now a fair chance of increased prosperity. He could not, himself, hope to survive many years to witness its further progress, but he should always feel the deepest interest in the Institute, with which he had been connected for the last four and twenty years. When he was first elected President, he had no particular pretensions to the office; and he felt his own inefficiency in every respect except goodwill,—of which he had abundance. Although, by their rules, the office of President was an annual one, they had invariably done him the honor to suspend the standing order, and to re-elect him, and he felt this as one of the proudest compliments which could be paid to any man, and especially to himself, as he had nothing to do with the profession personally. It was impossible for any one to hold so distinguished an office for so long a period without a strong feeling of gratitude, pride, and satisfaction, although the only pains he had taken had been to do his duty to the best of his ability. During the period he had referred to, the Institute had prospered greatly. The first meeting he attended was in King Street, Covent Garden, when it was a rising Society, but in 1834 (about a year previously) the number of members had been only thirteen. At that time there was another Society in existence, with which the late Duke of Sussex was connected. That was a very excellent and desirable Society, but it was thought advisable that the two should, if possible, be united, and ultimately their junction was effected. If they had remained separate, they might have been more or less conflicting, but as they had the same interests at heart, the contests would have been more apparent than real. The result, however, of their combination was, that instead of 13 Members, as in 1835, the Institute now consisted of no less than 154 Fellows, 139 Associates, 13 Honorary Fellows, 17 Honorary Members, 80 Honorary and Corresponding Members, and 13 Contributing Visitors,—making a total of 416; the Honorary and Corresponding Members being gentlemen living abroad, and feeling an interest in the Institute, including among them the most eminent architects in the great capitals of Europe. In the last year the Institute had lost four valuable and excellent members by death, but there were 14 nominations of new Fellows and Associates, and this, with the other facts referred to, showed that the Society had made steady, although gradual, progress. So early as the year 1835, Sir John Soane had given them a magnificent donation, and in 1836 the first Medal was given to Mr. Godwin, who, he was happy to see, was still an active, zealous and efficient Member of the Institute. In 1837 they removed from King Street to Grosvenor Street, where they occupied, in succession, two different sets of apartments. In 1838

the negociation for the junction of the two societies was commenced, and in 1842 it was completed, to the benefit and advantage of both. A year or two afterwards Her Majesty granted her Royal Gold Medal, which on the first occasion was conferred upon Professor Cockerell, one of their own members, whom he rejoiced to see then present among them. Always endeavouring to obtain better rooms, they could not succeed in doing so till last year; but having at length done so, he hoped and trusted they would long remain in them, and that the Institute would hold the position in the country to which it was entitled; and as long as he had any power to promote its interests his best exertions might be relied upon.

W. Tite, Esq., M.P., F.R.S., Fellow, read an Address

ON THE PRESENT CONDITION AND FUTURE PROSPECTS OF ARCHITECTURE.

[A copy of this Address has been kindly presented by Mr. Tite, at his own expense, to each Member of the Institute.]

The President proposed the thanks of the Meeting to Mr. Tite for his valuable, important and instructive Paper. (Carried by acclamation).

Professor Donaldson moved a vote of thanks to Earl de Grey for the kind interests which his Lordship had taken during so many years in the progress of the Institute. The Members owed a deep debt of gratitude to his Lordship for the judgment, ability, and kindness with which he had presided over their operations.

Mr. Tite seconded, with great pleasure, the motion of his honourable friend. In the printed copy of his Address he had endeavoured to express the obligations of the Institute to Earl de Grey, and could assure his Lordship of the sincerity of his remarks, for he believed that the present high position of the Institute was very much due to the influence which the social position of its noble President had brought to bear upon it.

The President, in acknowledging the vote, observed that it was most desirable and advantageous that different classes of society should be mixed together in the promotion of such a cause. He could only say that he felt an honest interest in this particular branch of art and science, though he knew very little of it professionally. Under these circumstances it was possible that it might be in the power of one in his position to do rather more than one who, being a Member of the Profession, might be supposed to have some interested motives. His Lordship declared the Meeting adjourned to the 21st instant.

ORDINARY GENERAL MEETING, 5th December, 1859.

The Chairman, Mr. G. Godwin, V.P., F.R.S., said,—I have, as the Vice-President, officially to inform you, or rather to announce to you a fact with which you are all well acquainted, and which you all deeply deplore; I mean the death of our late highly esteemed President, the Earl de Grey.

As he told us from this chair, when presiding for the last time about a month ago, he had been President of the Institute for twenty-four years. During that time he was constantly accessible to the officers of the Institute, always ready to sacrifice his own personal comfort and convenience for its advantage, and to take any steps which he considered calculated to conduce to its interest.

Gentlemen, you all know how he interested himself for us. I need not remind you that it was mainly through him that Her Majesty the Queen founded the Royal Medal of Architecture,—a foundation which seems to me one of the utmost importance to the art, and has tended more than any other step to advance the interests of the Institute abroad, and to increase the importance of its position at home. You are well aware too of those annual gatherings, where our late deeply lamented President, the Earl de Grey, brought together the most distinguished persons of all classes, whether belonging to the aristocracy of rank or of talent. Notwithstanding that ladies cannot be members of the Institute, still the presence of the fairer half of our race (whose presence is an example, and a means of refinement to, the sterner sex) was encouraged by the late Earl; and now the rule is that ladies shall be present at such meetings rather than not. I do not think any of you who saw the Earl four or five days only before his death, when presiding at the last meeting of the Institute, could have thought that he was seventy-seven years of age. You will, I am sure, well remember the hearty and kindly way in which he conducted the business of that evening. For myself, personally, I can truly say that I feel his loss exceedingly. He was so kind on that occasion as to refer, in his friendly way, to the fact of his having presented to me twenty years ago, I being then a student, the first medal of the Institute. Only a few days pass, and, as a mere matter of routine business, I have to announce, from this same chair which he then filled, his death.

The question of his successor as President will of course come before us, again, and will then receive that consideration which its importance demands. I suppose that the first way in which that question will present itself will be, whether we shall have a professional or a non-professional President. For my own part, I strongly incline to the notion that the President of the Royal Institute of British Architects should himself be an architect; because, selected as the President has been by the Government to preside on Commissions and Committees, and selected as he will be, I am sure, more and more frequently (for such matters will more and more demand the attention of the Government hereafter) it has seemed to me that the President should have that knowledge of the art which can only be looked for in a gentleman who has been engaged in such a profession. I think that the position of President of Commissions, and Chairman of Committees of Selection, will give dignity and weight to the presidential chair of this Institute, which should be looked forward to as being open to every member of it on commencing his professional career. However, this question is not now before us, and I have merely thrown out, for your consideration, that which is my own impression. I am quite sure that, however we may decide this question, or whoever we may elect our President, we shall not have one who more ardently and zealously discharged the duties of his office than did the late Earl de Grey, whose memory will long live in the hearts of the members of this Institute.

Professor Donaldson, in reference to that melancholy and impressive subject, read a letter, dated 4th December, 1859, addressed to him by the Central Society of Architects of the City of Paris, expressing their condolence with the late Earl's family, and their sympathy for the Institute under the severe loss it had experienced by his death.

Mr. Garling, Fellow, hoped that what had been heard this evening would have led this large meeting (as large as any he had ever seen) to express by vote the deep sense of gratitude they entertained to the late Earl de Grey, and of the great loss they had experienced by his death. He, however, was not prepared to bring forward such a motion, because he expected it would have been made by some gentleman of greater weight and longer standing than himself, and one who was better able to express in suitable language the deep regret of the meeting for the loss sustained.

Mr. Godwin.—Our Honorary Secretary will read a letter which has been addressed to the family of the late Earl de Grey by the Council of the Institute.

Mr. C. C. Nelson, Hon. Sec., accordingly read the letter, as follows:—

"9, Conduit Street, Hanover Square. W.
"17th November, 1859.

"Madam,

"The Council, representing the Members of this Institute generally, beg to offer to your Ladyship and the family, the expression of their most sincere condolence for the loss, recently sustained, by the decease of the Earl de Grey, your Ladyship's noble father.

"As President during the period of five and twenty years from the foundation of the Royal Institute of British Architects, his Lordship's ever ready, valuable assistance, and good counsel, and his never-tiring attention to all matters submitted to his consideration, have essentially contributed to elevate it to the position which it now occupies, and entitle his Lordship's memory to the lasting gratitude of its Members.

"The Council believe and trust they best conformed to the understood wishes of the family by not seeking permission to be present, to pay a tribute of respect, at his Lordship's funeral.

"We have the honour to remain,

"Madam,

"Your Ladyship's most obedient humble Servants,

"C. C. NELSON,
T. HAYTER LEWIS, } Hon. Secs.

"To the Right Honourable The Countess Cowper,
"4, St. James's Square."

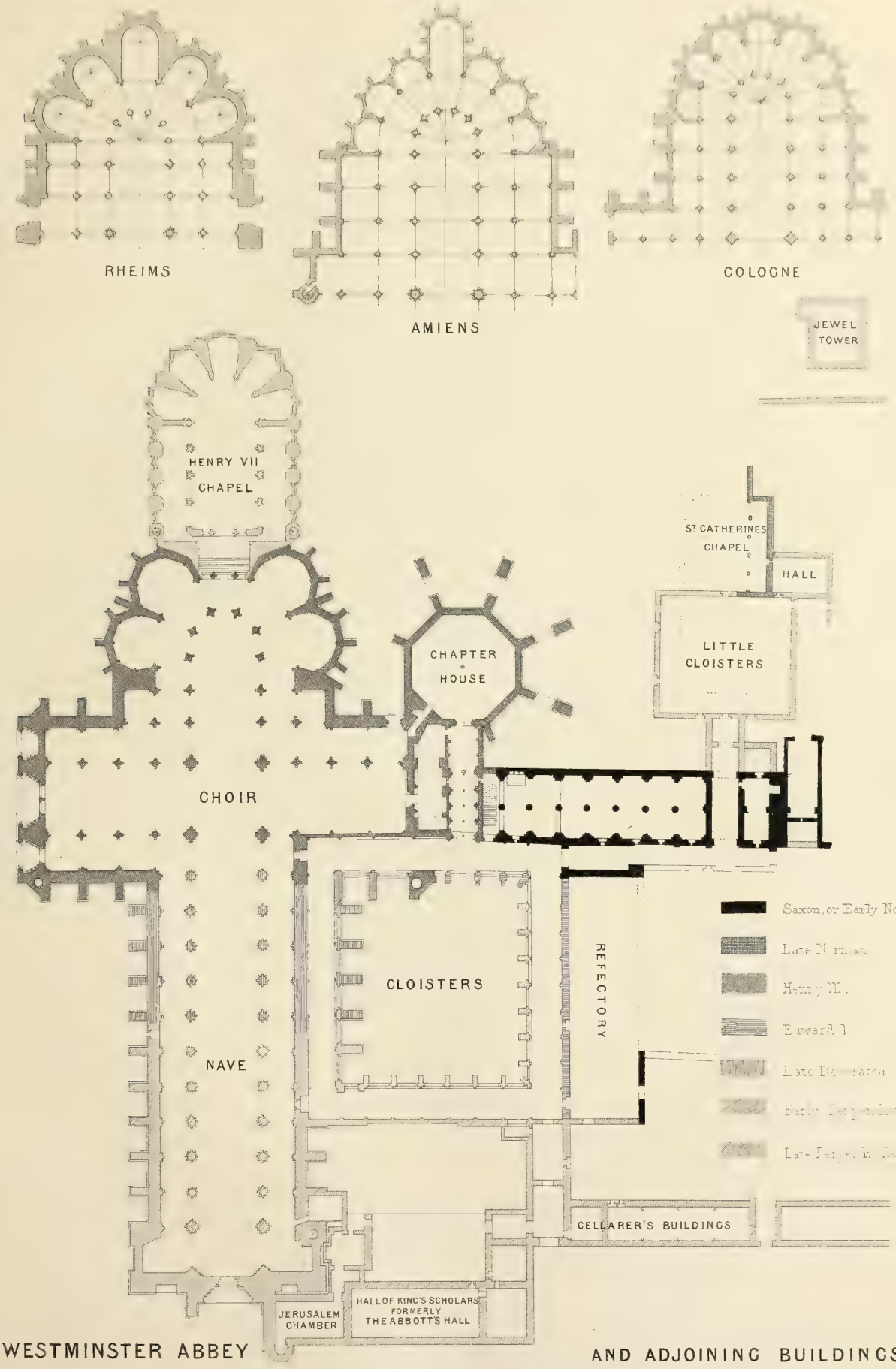
Mr. Garling said that the letter was very excellent so far as it went, but still it did not meet his view, which was that it should be an expression of the sentiments of the members of the Institute at large, and be placed on its Records.

Mr. Godwin.—It is competent to any member to bring forward a motion on the subject.

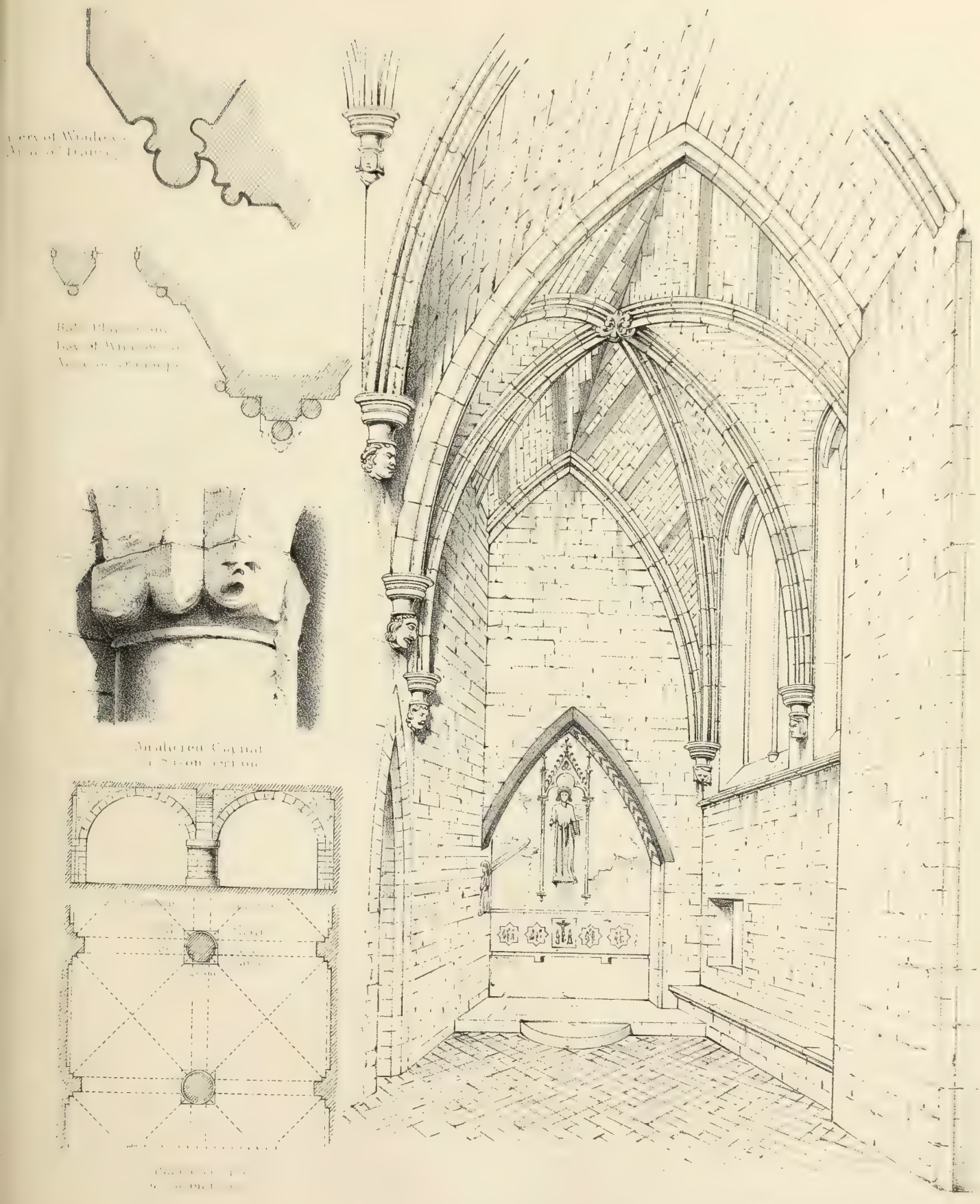
Mr. Digby Wyatt, Fellow, begged leave to move, "That this meeting desires to endorse the sentiments expressed in the Letter of the Council addressed to the Countess de Grey."

Mr. Garling seconded the motion.

The Chairman having put the motion, it was carried unanimously.



PLAN OF WESTMINSTER ABBEY AND ADJOINING BUILDINGS



GLEANINGS FROM WESTMINSTER ABBEY.

By G. Gilbert Scott, Fellow, A.R.A. Read at the Royal Institute of British Architects, December 5th and 19th, 1859.

I have given my paper this title with the intention of expressing that it is in no degree intended to be an historical, an architectural, or an antiquarian treatise on that magnificent building, but simply a casual account of objects and subjects connected with it, which, it has occurred to me, are less known or less noticed generally than they deserve. Though I use the word "gleanings," I do not mean that the harvest is over; on the contrary, the antiquarian and documentary part of the subject is, I am convinced, not only unexhausted, but scarcely entered upon: we really know next to nothing of the actual history of this the most nationally interesting of our English Churches. The information given in the published histories is meagre in the extreme, while the Public Records and the Archives preserved in the Church seem, as yet, to have been only very partially searched for information as to its structural history. I earnestly wish that some of our learned antiquaries would take this interesting task in hand. It needs long and laborious research, but I feel sure that the labour would be richly rewarded.*

All we know of the earliest history of the fabric is, that a Church existed here in the days of King Offa; and that it, or a successor, was rebuilt, and the Abbey refounded, by Edward the Confessor. Now, one of the first questions which occur is, what kind of Church was that which preceded the present structure, and which we know to have been erected by that sainted monarch. What was its size, and what its form? Was it on the small scale which appears to have been common amongst the Saxons, or of the gigantic dimensions adopted by the Normans? Again, was its architecture more after the Saxon or the Norman type?

William of Malmesbury, writing in the following century, speaks of it as "that Church which he, the first in England, had erected in that mode of composition which now nearly all emulate in its costly expenditure." In other words, it was the earliest Norman Church. Matthew Paris, in the thirteenth century, merely adapts the same statement to his own times, saying that the Confessor "was buried in the Church which he had constructed in that mode of composition from which many of those afterwards constructing Churches, taking example, had emulated in its costly expenditure;" evidently considering its style the same as that of the Norman Churches with which he was surrounded. Sir Christopher Wren gives, as he says, from an ancient manuscript, the following particulars:—"The principal area or Nave of the Church, being raised high, and vaulted with square and uniform ribs, is turned circular to the East; this on each side is strongly fortified with a double vaulting of the Aisles in two stories, with their pillars and arches: the cross building contrived to contain the Choir in the middle, and the better to support the lofty Tower, rose with a plainer and lower vaulting, which Tower, then spreading with artificial winding stairs, was continued with plain walls to its timber roof, which was well covered with lead."†

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* Since this sentence was written much has been done to forward this object by my friend Mr. Burtt, of the Record Office, which will be found noticed hereafter.

† This is, I find, a free translation of a passage in a life of the Confessor, written within seven or eight years after his death. It is in the Harleian Library, and is printed in one of the volumes recently published under the direction of the Master of the Rolls. From the remainder of the passage, we find that the old Saxon Church was not taken down till all the Eastern parts of the new one were finished; and that these were placed so far to the East of it as to allow of a considerable part of the Nave being erected between them. As the King died very soon after the consecration, it is probable that the completion of the

From the above, we should by no means infer that the Church was of small dimensions; and I am very much disposed to think that it may have been nearly, or quite, as large in its elementary scale as the present structure. Edward the Confessor having spent much of his early life in Normandy, it is unlikely that he would be content with the dimensions of a Saxon Church; (indeed, had he been so, he had one ready built to his hand), and, as he was greatly enlarging the monastic establishment, it seems probable that, in rebuilding the Abbey Church, he would adopt the scale which was becoming common in Normandy. Harold, we have every reason to believe, did so in building his Church at Waltham; for whatever the merits of the disputed question whether any part of his work yet remains, there can be no doubt that his Choir, at least for a time, co-existed there with the present Nave, and agreed with it in elementary scale. Again, we have no reason to believe that the Choir of Westminster Abbey was rebuilt between the days of Edward the Confessor and those of Henry III., which would have been inevitably the case had its scale been diminutive; and, if it did exist through that interval, we have full proof that it was as long as the present Eastern arm of the Church; for the present position of the Transept we know to be identical with that of the Confessor's Church, because the remains of his Dormitory abut against it in the usual manner; while the Eastward extent of the old Church is defined, almost with certainty, by the fact that the Lady Chapel was erected against it in the early days of Henry III., some years before he commenced rebuilding the Church itself. The dimensions of the ancient Nave are less easy of conjecture. I think it probable its width would have agreed with that of the existing one; and if the Confessor adopted, as I imagine, the usual scale of the great Churches of the Normans, there is no reason to suppose it to have been much shorter,—an opinion to a certain extent corroborated by the size of the Cloister-Court; the North and East sides of which would have been defined by the external walls of the Nave and the Dormitory, and the Southern limits by the Refectory, in which there exist early remnants sufficient to show that it occupies its original site. The completion of the square thus marked out carries us to within three bays of the Western Towers; and as the Cloisters rarely reached the end of the Nave, it leaves the probable inference that the old Nave did not fall far short of the length of that now existing.

At St. Albans and Winchester, erected within the same century, the elementary scale, or width from centre to centre of the piers, is about the same; but the length of the Nave is considerably in excess, and the original length of the Norman Choir is also greater. The structural Choir, or Eastern arm, at Westminster, is, in fact, so short as to preclude the idea of its having been rebuilt during the later Norman period; its length being less than that of many early Norman Choirs.

We now come, however, to surer ground. I mean the portions of the Confessor's work which still exist. These consist of the substructure of the Dormitory, forming a long range of building running Southwards from, and in a line with, the South Transept, and passing under the Library and the great School-room, which now occupy the position of the ancient Dormitory. The substructure is vaulted in two spans, and divided longitudinally by a range of massive round columns; the whole being seven and a-half bays, or about 110 feet, in length from the Vestibule of the Chapter-House to the cross passage now leading into the little Cloister, and formerly to the Infirmary. This range was, probably, in the first instance, continuous and open, like that at Fountains Abbey; but it was very

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Nave was subsequent to his death. From another life of the Confessor, published in the same volume, and written in the time of Henry III., we find, in addition to the above information, that there were two Towers at the West end. That these were contemplated from the first, may be inferred from the use of the term "Mædia Turris," by the earlier writer. The later account speaks of the pillars being carved, and the whole carried out with good and "loyal" workmanship. It also mentions the Dormitory, the Chapter House, the Cloister, the Refectory, and "Offices in a tower," as having been erected by the Confessor.

early divided into separate compartments. It is so seldom that we find constructive columns remaining in this country of a date earlier than the Norman Conquest, that it is of interest to see what form they exhibit, though I admit that, date alone excepted, this can hardly be called a Saxon work; whilst its unimportant purpose forbids our taking it as a fair example of any style. There are only one or two, I think, of these columns retaining the pristine form, the others having been altered at subsequent periods.

The former consist of a cylindrical shaft, 3 feet 6 inches in diameter, and 3 feet 4 or 5 inches high. The Capitals have a vast unmoulded abacus, 7 or 8 inches deep, supported by the frustrum of an inverted cone; almost the most pristine form to which a Capital can be reduced, but thoroughly efficient with the least possible amount of workmanship; not unlike what we may imagine may have been the first type of the Doric Capital, and but one step removed from its apparent prototype among the tombs at Beni Hassan. We must not, however, suppose that this rude form was that usual at the period, except in rough and unimportant situations. We know that in the contemporary work at Waltham, the Capitals were enriched with ornaments of brass, and that much earlier Saxon columns had enriched capitals. We must simply view it as a specimen of the honest simplicity with which the less important portions of the structure were treated. It is, in fact, only one step more plain than the Capitals in the Crypt at Winchester, which was constructed some twenty years later. The Bases very closely resembled the Capitals, but they have generally been altered from their original form. These columns carried plain groining, with square transverse ribs, partly constructed of tufa. It is curious and interesting to observe that, during the Norman period, the majority of the Capitals have been altered and enriched in various ways. Being within reach, their massive plainness seems to have tempted the monks to try experiments; and we find the original block cut into a great variety of forms, some of considerable richness. The state of the Capitals shows that the building was already subdivided, as the alterations are often totally different on the two sides; a narrow intervening frustum of the original representing the thickness of the partition. Some are roughly chopped into form, preparatory to the enriching process, which has not been completed. The Bases have also been altered; and, in some instances, the floors have also been so much lowered, that the lower part of the columns had to be cased with new stone.

The first bay of this early work adjoins the Outer Vestibule of the Chapter-House, and is imperfect; having been shortened by the later buildings which abut against it. The Capital of the column here visible is entirely altered to a round and slightly enriched form.

Next to this comes the celebrated Chapel of the Pyx. This, as is well known, has long been held by the Government. It formerly, I believe, contained the Records of the Treasury, but it now contains only empty cases and chests; with one exception, that in which the paraphernalia for the trial of the Pyx are kept.* It occupies two bays of the Confessor's work; a detached column standing in the centre. This column bears marks of a partition having at one time abutted against it, on one side of which the Capital has been made round and slightly enriched; while on the other it has undergone no change but rough canting off its angles, as if preparatory to further alteration. The column which is partly built up in the North wall is, on this side, altered exactly as on the other seen in the adjoining chamber; a proof that there was there no partition against it. That on the South side I was not able to examine, on account of the presses by which it is concealed: as the portion visible on the

* I have recently, through the kindness of the Chancellor of the Exchequer and the Secretary to the Treasury, visited, for the first time, its mysterious recesses:—a formidable visit, requiring the presence of representatives of the Treasury and the Exchequer, with their attendants, bearing boxes which contain six mighty keys.

other side of the wall is part of one of those which have their Capitals unaltered, I was anxious to see if the opposite side was similar. In one of the Eastern bays of the Chapel the stone Altar remains nearly entire. It is perfectly plain, and has in the middle of its top a large circular sinking, apparently for the reception of a portative Altar-stone; though the form is, I believe, unusual. Adjoining the Altar is a detached Piscina, in the form of a column. It appears to be of the thirteenth century. The windows, which are very small, and probably of the same date, are doubly and very closely grated; and well they might be! for we learn that during the reign of Edward I. the Treasury here was robbed of £100,000, which he had laid up for the Scotch wars. For this theft the Abbot and forty monks were sent to the Tower on suspicion. I imagine that the chamber was brought to its present form, and its security increased after that event. The bays of the early work beyond the cross passage to the little Cloister are simply waggon-vaulted, as is that passage itself; as well as that which is called the dark Cloister, which I suppose to be of the same age. These waggon-vaults are formed of tufa laid in rubble-work, still showing the impression of the centering boards in the mortar. Of the walls of the Dormitory* itself considerable portions remain. Several of its walled-up windows are visible in the great School; and the exterior of one remains little altered excepting by decay. It has a shaft in each jamb, and resembles an Early Norman window. The only other part at all likely to belong to the Confessor's buildings is a part of the South wall of the Refectory, in which round-arched wall-arcading is still to be traced. As the Confessor increased the number of monks to seventy, he would have to provide *eating* as well as *sleeping* room in due proportion; and, in the absence of opposing evidence, it is likely that this may be a portion of his Refectory.

The next building I will notice is the Chapel of St. Catherine; a work of the succeeding century. It was the Chapel of the Infirmary; and it occupies a position not dissimilar to corresponding Chapels at Canterbury, Ely, and Peterborough.

The usual plan of the Infirmary in a monastery was very similar to that of a Church; with this difference, that the quasi-Nave was very long and divided, at about one-third of its length from the East, by a cross wall perforated by a central doorway. The Western portion formed the Infirmary proper; the Eastern portion being the Nave of the Chapel with a Chancel, extending still further Eastward.

This arrangement allowed the sick monks to hear the service as they lay in their beds, while the convalescent could readily betake themselves to the Chapel. It may still be traced at Canterbury, Ely, and Peterborough; and there is a nearly similar building still in use (though unconnected with the Cathedral) at Chichester; also (with more or less variation) at Bruges, Lübeck, and, I dare say, in many other places. I think it possible that the Westminster Infirmary may originally have been of the same description. The Chapel, of which the remains are sufficient to show its plan, agrees with it precisely; but the Infirmary proper is gone, and it may have been destroyed when the small Cloister was built. If so, it, no doubt, extended Westward to the wall of the Dormitory. This, however, is a mere suggestion, which would be set aside if the small Cloister be proved to be of early date, as Widmore imagines. In that case, I should suppose that the Infirmary surrounded it.

I have recently discovered an old Hall of the date of Abbot Litlington, who is known to have built a new house for the Infirmarer. It abuts upon the South side of St. Catherine's Chapel, into which it has a doorway. It was, no doubt, the Hall of the Infirmarer's house, and probably used by convalescent patients. The Garden, now called the College Garden, was originally the Infirmary Garden.

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* The dormitory was partially burnt in 1448.

The Chapel consisted of a Nave and aisles, five bays long, with a Chancel of which I cannot ascertain the length. It is of very good Late Norman; and in its details much resembles that at Ely, even to the setting of the octagonal columns angle foremost; but it is less rich. The West doorway is of Abbot Litlington's time (Edward III. and Richard II.) The pier of the Chancel Arch was discovered last year, while alterations were being made in an adjoining building, but it was unfortunately destroyed before I could see it. The Hall I have mentioned had a gallery extending over the Aisle of the Chapel, with a fireplace in it. I have been able to preserve and expose to view the Hall with the exception of this gallery, which I was unable to save, though its fireplace still exists. The parts of the Chapel, which were formerly enclosed in the adjoining building, are now also visible.

The only other Norman remains I am aware of are some rather rich fragments, found under the Nave floor, when the new Stalls were being erected in 1848. I see that in the time of Henry II. or thereabout, stalls are mentioned as being made for the "new work." This looks as if the Western part (which contained the Stalls) had been rebuilt; but I am inclined to think that the "new work" was the Chapel of St. Catherine just built, the Altar of which is said to have ranked second among all.

I have dwelt much on these early features, because they are generally but little known.

I now come to the existing Church; a building which does not owe its claims upon our study to its antiquarian and historical associations; intensely interesting though these must be to every man worthy of the name of an Englishman. It has claims upon us as architects, I will not say of a *higher* but of *another* character, as a work of art of the highest and noblest order; for, though it is by no means pre-eminent in general scale, in height, or in richness of sculpture, there are few Churches in this or any other country, which possess the same exquisite charms of proportion and of never-tiring artistic beauty. The period of its erection was one of the great Transitional epochs of our Architecture. During the latter half of the twelfth century the Romanesque, or Round-arched Gothic, had, both in France and England, transformed itself by a thoroughly consecutive and logical series of changes into the Pointed Arched Style; and in each of those countries that style had been worked into a state of perfect consistency, and had assumed its national characteristics; so that the works in the Choir at Lincoln, the Lady Chapel at Winchester, and the Western Portals of St. Albans and Ely, all of which date from 1195 to 1215, mark the perfectly developed Early English style, and are readily distinguishable from the contemporary works in France.

The English works of this period have, at least to our eyes, a more advanced appearance than the French. The round form of the abacus, the greater richness and delicacy of the mouldings, and generally the more decided severance from the massiveness of the Romanesque, give them a later appearance than we observe in buildings of the same period in France. The leading characteristics are, however, much the same. The windows especially, in both countries, consist, for the most part, of individual lights, placed either singly or in groups. The chief variety is when, as is usual in the Triforium openings and in Belfries, two or more lights are placed under a comprising arch, the interval below which is usually pierced with circular or other openings. This was not, chronologically speaking, a step in advance of the detached light, but it had all along been its contemporary, whether in the Romanesque, the Transitional, or the Early Pointed styles; and both were equally in use in France and in England. In domestic work, the last-named type (that with two or more lights under a comprising arch) was always prevalent, on account of the smallness of the intermediate divisions, which, from an early period, it was customary to reduce to a thin shaft of marble or plain stone; as we see in our own country even in Romanesque works, in the Jews' House and in the building called "John of Gaunt's Stables" at Lincoln, Fountains Abbey, and Richmond Castle.

As a general rule, however, the more detached form was, for a long time, the prevalent one in Churches both in France and in England. The difference in the two countries was, that, while in England the energies of the builders were specially directed to perfecting the more usual type, the French began early in the thirteenth century to show a preference for the other, and rather to neglect the perfecting of the more typical form. Both forms were frequent in each country, but the efforts of the English were rather directed to one, and of the French to the other. The consequence was that, while in England the grouping of distinct lights was being brought to the utmost perfection, the French were engaged more especially on a number of tentative steps towards what afterwards became the mullioned and traceried window. I will not attempt a history of this invention, but I will just call attention to one or two of its stages. At Bourges we have the earlier type in full perfection; the spaces between the comprising and comprised arches and the piercings of the head being flat faces. At Le Mans and Tours we find these spaces cut out parallel to the lines of the openings, not, however, moulded into what is called *bar* tracery, but as if sawn square through; a clumsy and crude contrivance, very inferior to the plate tracery it was intended to improve. At Rheims, so far as I know, is seen the earliest introduction of the perfected principle. We find there, for the first time, I believe, the pierced spandrels and gussets moulded as the openings themselves; and the principle of bar tracery completed, though with some remaining imperfections. It is very difficult to fix dates to these transitions. Rheims Cathedral was commenced in 1212, and it is generally supposed that the first architect, De Coucy, completed the Aisles in 1220 or 1225. M. Viollet-Le-Duc, naturally enough, seems surprised at finding perfect traceried windows at so early a period, and suggests that it is probable, as the Transept of the same work does not exhibit equal advancement, that the Aisle windows were altered by him a little later. Certain it is that neither Bourges nor Chartres, which were built about the same time, give any evidence of a like progression; while the intermediate step at Le Mans and Tours would appear, from many of its accompanying details, to be of later date than that given to Rheims. Had Villars de Honnecourt put a date to his sketch-book, which gives these very windows at Rheims, the difficulty would, perhaps, have been solved.

The windows with similar tracery at Notre Dame at Paris, M. Viollet-Le-Duc, from internal evidence, dates from 1235 to 1240. The Cathedral at Amiens presents difficulties as to date almost equal to that at Rheims; but, on the whole, we may fairly suppose this development to have become pretty common in Northern France by about 1230 or 1235, though not to the extent of superseding either the detached light, or the plate tracery. Pierre de Montereau, the architect of the Sainte Chapelle, in which the perfected tracery prevails, built also the Refectory of St. Martin aux Champs, in which it does not appear at all.

During the same period the peculiar, and afterwards stereotyped, French arrangement of the Chevet, or Apse, with its group of Radiating Chapels, had been brought, by many steps, to its final development. Radiating chapels, growing out of the main Apse or its Aisles, had been early used. In this country we find them at Gloucester and Tewkesbury, and in the foundations recently excavated at Leominster, all of the Romanesque period; and later we find them at Pershore. The French characteristic, however, was the arranging them in polygons fitting to one another, and to the sides of the polygonal Aisles of the main Apse,—a sort of corona of little Chapels mathematically fitted together; their axes radiating to the centre of the Apse, at or near which the High Altar was usually placed. This arrangement we find in many tentative forms, but the system appears to have been brought to perfection at Rheims and Amiens—the latter of which Churches appears to have been taken as the type, on which, in the majority of subsequent cases, though subject to some varieties, the grouping of Eastern Chapels was founded; as at Beauvais, Cologne, Altenberg, and numerous other

churches. The two German Apses last named seem, however, to have had Beauvais rather than Amiens for their immediate type.

There can be little doubt that Henry III. during his sojourns in France, became conversant with this arrangement, which, in its perfected form, he might have seen in course of construction at Amiens, Beauvais, Rheims, and elsewhere. It would naturally strike him as well suited for the reconstruction of the Eastern portion of a Church, already possessing an Apse with a continuous surrounding Aisle. Whether this project had been formed when the Lady Chapel was built in 1220, it is impossible to ascertain. This Chapel was begun in the same year as Amiens Cathedral, and eight years later than Rheims; so that it is not impossible, though the extreme youth of the King would in that case compel us to transfer the originating the scheme from him to the Abbot. However this may have been, it is probable that it agreed readily with the subsequently adopted plan; as we find no disturbance of the regularity of division which would otherwise have been the case.

Judging from internal evidence, which is all we have to depend upon till the public documents and the Archives of the Abbey are more thoroughly searched, I should imagine that an English Architect, or master of the works, was commissioned to visit the great Cathedrals then in progress in France, with the view of making his designs on the general idea suggested by them. Would that, like his contemporary Villars de Honnecourt, he had bequeathed to us his sketch-book!

The result is precisely what might have been expected from such a course. Had a French Architect been sent for, we should have had a plan really like some French Cathedral; and it would have been carried out, as was the case with William of Sens' work at Canterbury, with French details. As it is, however, the plan, though founded on that common in France, differs greatly from that of any existing Church; and it contains no French detail whatever, excepting the work of apparently one carver. I have sometimes fancied that I could detect a French moulding in the water-tabling of the external buttresses; but these are themselves restorations, and so decayed that I cannot make sure of their section. If it be so, it is just one of those exceptions which prove a rule. The Architect, however, in imitating the great contemporary Churches in France did adopt another of their great characteristics, the bar tracery of the windows. I am not aware that this exists in a perfected form in any earlier English work, though often closely approached. It is said that Netley Abbey was erected about 1240, and the Eastern part of Old St. Paul's is said to have been consecrated in that year. As both of these contained perfected tracery, the substantiation of those dates would establish for us an earlier claim; but, on the whole, I think we may fairly yield this development to our neighbours, and consider this to be about the period at which we borrowed it; though, so perfect is the catena of transitional steps, that, had it not been for external evidence, we should have no difficulty in tracing out the history of the development from English examples; the only step which I miss in them being that which is seen at Le Mans and Tours, on which, however, I have never heard any stress laid.

The Church at Westminster is, then, remarkable for exhibiting—1st. The introduction of the French arrangement of Apsidal Chapels, which, however, failed to take root here: 2ndly. The completed type of Bar Tracery, which was no sooner grafted on an English stock than it began to shoot forth in most vigorous and luxuriant growth.

Though the French type was, as a general form, adopted here in planning the Chevet with its circlet of Chapels, I know of no French Church from which the actual plan could have been taken. The simplest mode of setting out the Chevet with its Chapels is that employed at Rheims: viz. describing a semicircle upon the tranverse line passing through the Easternmost of the main range of columns, of a diameter equal to the width from centre to centre of those columns, and inscribing in it a semi-

decagon, whose angles give the centres of the piers; the same operation being repeated for those of the Aisles.

At Amiens the system is different: two semicircles are described, one for the piers and the other for the Aisle, and about each of these, it would seem, the normal idea was that a portion of a dodecagon should be circumscribed; but, in fact, the sides are a little less than those of that figure. On the outer circuit of the Aisle, seven angles of the quasi dodecagon represent the centres of the piers between the Radiating Chapels, while, on the inner circuit, five angles of the smaller quasi dodecagon represent the centres of five of the piers of the Apse; the two remaining piers being placed at the points where the transverse line, which cuts off the seven sides of the outer Apse, intersects the longitudinal lines, which pass through the centres of the main ranges of piers. It will be seen that this gives a bay of a width intermediate between those of the Apse and those of the main arcade; but in a line with the latter. The Chapels are alike in the width of their arches, but differ in the Western-most sides of the Western Chapels not radiating in a regular manner.

The Chevets at Beauvais and Cologne differ from that at Amiens in this, that the dodecagons are *in*scribed, instead of being *circum*scribed. It follows that only five of the angles of each dodecagon represent the angles of the outer or inner Apse; the remaining angles of the former are formed by spreading the side of the figure outwards till it intersects the line of the Aisle wall; and those of the latter by drawing a transverse line from these points to its intersection with the longitudinal lines of the main range of columns as before. The consequence is, that the first side of the Apse has a slight inclination, instead of being parallel to the axis of the Church. *

The Chevet of Westminster differs greatly from any of the above. The sides of the Apse are five in number, as at Rheims; but instead of being five sides of a decagon, the three Easternmost are sides of an octagon, and the others incline but slightly from the sides of the Church. The great peculiarity, however, is in the Chapels, which occupy so much more than the semicircle as to do away with one of the non-Radiating Chapels; reducing the space it usually occupies to an irregular pier, and introducing opposite to it in the Aisle a bay of very irregular form. I had long noticed this peculiarity, though I had thought it an irregular contrivance to give greater size to the Apsidal Chapels; but finding the setting out the work remarkably exact, I was led to think that some mathematical principle must have been followed; and, having had most careful measurements made and tested in every way, I find it to have been the case. The system is this. Two semicircles are drawn as before, the diameter of the inner one being the width from centre to centre of the columns; a semi-octagon is inscribed in this, three of its angles give the centres of the piers of the outer and inner Apses, the remaining sides of each Apse being formed by spreading them till they meet the main longitudinal lines. It most resembles the principle followed at Beauvais, but differs from it (besides the smaller number of the sides) in the outer and the inner Apse being exactly alike in principle, with all their sides equal; and both set out in regular radiating lines, instead of the transverse line adopted at Beauvais. This system has great advantages: it avoids the narrowness of the Apsidal bays, so apparent in most of the French examples; it gives a beautiful gentleness of transition from the main arcades into the Apse, and also great boldness and expanse to the Chapels,—advantages purchased cheaply at the expense of one of the square Chapels on either side, and of a certain degree of picturesque irregularity in the Aisles. It should be mentioned that the setting out of this Church is remarkable for its regularity and exactness; though the drawing of an intricate mathematical figure on the ground, some 120 feet wide, necessitated some trifling deviations from absolute precision.

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* These definitions are open to some modifications for irregularities admitted in the setting out.

The section of the Church, also, differs much from that of the great contemporary buildings in France. The earlier French Pointed Churches retain the Romanesque system of having not a mere Triforium, but a distinct upper story over the Aisles; often with a second range of vaulting. The same occurs, though not vaulted, in many of our own Early Pointed Churches; especially where they resulted from the piecemeal reconstruction of their Norman predecessors. At Amiens and Rheims, as at Salisbury, Whitby, Rievaulx, and, indeed, in the majority of our Churches of the thirteenth century, this second story was represented only by the space intervening between the roof and the vaulting of the Aisles. At Westminster, however, for some special reasons, the second story, which we know to have existed in the Confessor's Church, was continued in its successor, probably to admit more numerous spectators on grand occasions; such as Coronations and Royal Funerals. It was obtained, not so much by increasing the height of the Triforium arcade, as by flattening the Aisle roof, so as to allow of a wall of considerable height to the Triforium; the story being lighted by short windows of a quasi-triangular form filled in with cusped circles. The spaciousness of this upper story is surprising. It is capable of containing thousands of persons, and its architectural and artistic effects, viewed from different points, are wonderfully varied and beautiful.

I have sometimes, however, doubted whether this arrangement was contemplated when the building was commenced. There is about the intersection of the Aisle roof with the flying buttresses a want of system, which does not seem of a piece with the studied exactness of other points of the design, but is more like the result of alteration during its execution. It gives also to the Transept elevation a high-shouldered look, detrimental to its elegance; and while it adds to the External importance of the Aisles, it rather takes from the dignity of the Clerestory, by concealing its natural spring from behind the abutting roof of the Aisles. I may mention that the very same arrangement was followed in the contemporary work in the North Transept at Hereford; indeed, the very Cusping of the circular windows, which I have recently discovered there, seems to be exactly copied from those in the same position at Westminster.

Of the mathematical proportions on which the design of the Church has been founded it is hardly safe to speak: this is a subject on which so much uncertainty and consequent difference of opinion exist, that it would be unwise to be dogmatic; or to adopt any theory too positively. The proportions are, however, so pre-eminently satisfactory to the eye, that it is not unprofitable to examine into them; for whether the result of accident or intention, the lessons to be learned are the same; indeed, it is, perhaps, almost more instructive to find that proportions arrived at by tentative experiments, and a correct eye, coincide with some mathematical principle, than, after trying many geometrical formulæ, to find one which gives a result satisfactory to the eye. That beauty of proportion may be reduced to mathematical principles I have no doubt; but, as mathematical forms are of infinite variety, and of very unequal beauty, while the reasons why one is more pleasing to the eye than another are, to say the least, very occult, it seems to follow that the laws of proportion must be investigated by a process partly tentative and partly geometrical; the proportions dictated by the eye and those resulting from mathematical forms being mutually tested, one by the other, till we are able to determine which set of geometrical proportions is most beautiful, and which among the forms which please the eye are capable of being reduced to mathematical proportions.

As an illustration, I remember, many years since, while looking at a plate in "Britton's Antiquities," which gives internal arches from a number of our Cathedrals, I set myself the task of determining which were the most beautiful in their proportions. To my surprise, I was compelled to choose the two which apparently most differed the one from the other; in fact, the tallest and the shortest of the set. I was perplexed at so contradictory a result, but as I could not dispute the dictates

of my eye, I endeavoured to investigate the cause, and had much pleasure in finding that both (as shown in the drawing at least) might be resolved into equilateral triangles; the Westminster arch having three, and that from Wells only two of them in height. I have heard that in an old work of the Freemasons it is said, that good proportions may be obtained from the Square, but better from the Equilateral Triangle; and I have little doubt that it is true. If the principle of the Triangle is applied in the present case, the main section may be said to have a height of three equilateral triangles described upon the transverse width of the Church from centre to centre of the columns; a dimension which seems, in all Churches, to have been taken as the elementary scale on which the proportions were founded. Another proportion, common in old works, is derived from the Diagonal of the Square of this measure. Both have been claimed as the system made use of at Westminster; but the more closely we examine into it, the more clear it is that the equilateral triangle is the figure used. I have made careful measurements, and find they fully establish that this is the case. I find that the elementary width is about five inches greater in the Transept than in the Choir and the Nave. Possibly it had been affected in the latter case (as it would appear to have been in the Aisles) by some accidental cause; for the difference is clearly not accidental, but it is most systematically carried out and adhered to throughout to a fraction. If we take the larger of these dimensions, it will be found to agree very closely indeed with the different parts of the Church. The height of the Nave exceeds the three triangles, only by about 8 inches. The height to the Triforium string-course exceeds half that dimension, or the three triangles of the semi-scale only by 4 inches; and the height of the Triforium itself is 4 inches in excess of one of these minor triangles; differences so small as to be invisible in so great a height. This agrees with the theory laid down by Professor Cockerell, in his excellent paper published by the Archæological Institute in their Winchester volume. He states, that if we assume double Aisles to the Nave, (*i.e.*, if we treble the elementary width) the equilateral triangle described on this width will give the height of the vaulting. In the Ichnography, the proportions are far less exact. The idea would appear to be that the length of the Church should consist of four, and the length of the Transept of two of the heights of the great triangle last named. This is, however, by no means exact, and we cannot lay much stress upon it.* I may mention that the same system holds good in the Chapter House, the height of which agrees with that of an equilateral triangle described on its diagonal; or, more properly, each of its arches, from the central pillar to the angle shaft, has the height of two triangles, or of a regular Vesica piscis.

The details of the Internal design greatly exceed in richness those of French works of the same age, excepting only in the extent to which the Capitals are foliated. The arch mouldings are peculiarly beautiful. The Triforium arcade is as beautiful, perhaps, as any which can be found. That to the Eastern part of Lincoln may be richer, but its proportions yield to those of Westminster. The effect of the whole is vastly increased by the wall surfaces between the arches being enriched with a square diaper. The wall arcading is of exquisite design: the spaces over it were filled with most beautiful foliage, interspersed with figures, while the spandrels of the cusping were finished with ornamental painting. When, to the richness of architectural detail, was added that of material—the entire columns and all the subordinate shafts being of marble, and the remainder of stone of several different shades of colour, the magnificence of the internal design must have greatly exceeded that of its French prototypes. The only one point which strikes the eye as looking less rich, is the use of

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* From further examination since writing the above, I believe that both in the Aisles of the Nave, and in the lengths of the Church, and of the Transept, the proportions reached to the centres of the walls, instead of (as was more usual) their internal face. If so, the last named proportions would be almost exact.

merely moulded Capitals to the main pillars. This, however, arose from the use of Purbeck marble. It is true that at Ely and elsewhere, as in our own Chapter House, the carved Capitals are of this stubborn material; but its use may, nevertheless be accepted as a fair excuse for moderating the workmanship. The Internal design of the Transept ends is truly magnificent; indeed I doubt whether their equal can be found. The manner in which they continue the lines of the general design, and yet add diversity to the forms, is truly artistic.

It is most unfortunate that the great Rose Windows have lost their original character; I have, however, a strong impression that the old ones may have, in their leading subdivisions, resembled that now existing in the South Transept, and that the design has been simply translated from the style of the thirteenth, into that of the fifteenth century. I have attempted in my drawing to translate it back again; and it makes a very fine window, in perfect accordance with the character of the Church, and very much like several existing specimens. It may be said that this is pure conjecture, but it is not devoid of collateral corroboration; for there exist in the Chapter House some Encaustic Tiles of a pattern evidently copied from a Rose Window, agreeing precisely in its divisions with that under consideration, and representing even the shafts with their caps and bases. It will be seen that my translation of the existing window into Early English almost precisely resembles the pattern given on those tiles. The square form in which the circle is inscribed seems to be original, from the systematic way in which the vaulting is accommodated to it; but it must be admitted, on the other hand, that there are in the Eastern jamb of the South window some indications of the design having been altered from the original intention; though, I think, this was an alteration made during the progress of the work, as neither the opposite jamb of the same window, nor either jamb of the opposite one show any such indications. The South window was, I believe, renewed in the fifteenth century; and again, in the seventeenth: Sir Christopher Wren informs us that it had been renewed about forty years before the date of his report. The North window received its present form in the eighteenth century, and it in no degree resembles its predecessor. Whether that which Sir Christopher Wren reported in a dangerous state was the original one, there is no means of ascertaining.

The works undertaken by Henry III., and completed in 1269, terminated immediately to the West of the Crossing: the line of junction can be readily traced. I think the older work may have included one bay of the great arcade and Aisles; or, to say the least, some of its details were continued in that bay; but in the first Clerestory windows of the Western arm the change is clearly seen in the diversity of the Eastern from the Western jambs.

The five bays West of the Crossing are the work of Edward I. They differ chiefly from the work of his father in the plan of the columns, which have four attached and four detached shafts (the latter in most instances secured by fillets of brass); in the greater number of the ribs in the vaulting; and in the substitution of shields for carved enrichments in the spandrels of the wall-arcading. The rib-moulds of the vaulting are also different; the capitals of the wall arcading are moulded instead of carved, and the Triforium has no enrichments in the arch mouldings; but, in the main, the design may be considered to be the same. In both, the carved foliage is at the point of transition from the *conventional* to the *natural*. It is not in any degree *intermediate* between the two, for they stand on equal terms side by side, each in its integrity, and each excellent of its kind. Unhappily, however, sculptors of *more recent* times, convinced that Gothic architecture is discordant with their own "high art," have shown such determination in destroying, root and branch, the discordant element, and the destructive atmosphere of London has evinced so strong a sympathy with them, that we have little left of the carving of the lower parts (on which the greatest amount of study had been expended), but a

few mutilated and crumbling fragments—"the gleaning of the grapes when the vintage is done." These melancholy relics are, however, sufficient to show us the value of what we have lost.

I have before mentioned that the hand of one French carver may be traced in the work. This is the case chiefly among the Capitals of the wall-arcading. Many of these are of the English type of the period, but amongst them are two kinds, distinctly French. One is the "*crochet*" capital, the stalks of which are terminated, not as in English work with *conventional*, but with exquisite little tufts of *natural* foliage; such as may be seen in the wall-arcading of the Sainte Chapelle and many other French works of the period. In the other, natural foliage is introduced creeping up the bell and turning over at the top in symmetrical tufts. In both the foliage is smaller and less bold than was usual in French work, and the architectural form of the capital is English. The Spandrels over the wall-arcading are exquisitely beautiful. Some are only diapered in squares like those in the Triforium; some are enriched with conventional, some with natural foliage, with or without figures; and others with subjects. Those in the Western arm contained the shields of the great men of the day: the majority have given place to modern monuments, but the few which remain are nobly executed. They are curiously hung by the armstraps to projecting heads. In those parts of the Triforium which cross the ends of the Transepts, there have been figures in all the spandrels. Of these, the two central ones in the North Transept are gone, and the corresponding figures in the South Transept are much decayed; but those in the angles of both, being executed in a superior material, are more or less perfect. They represent Angels censing, and are exceedingly fine; due allowance being made for the height at which they were intended to be seen. Below these, in the North Transept, there are figures in the window jambs, and busts of Angels in medallions in the soffits of the window heads. They bear musical instruments, &c., and form what is called a "Divine Liturgy." They seem to have been well executed, though now much decayed. The Bosses of the vaulting are generally very nobly executed, particularly those over the Choir (Edward I. work, West of the Crossing); some of which are among the finest I have ever seen. Several Bosses in the Western Aisle of the North Transept contain well executed figures and groups surrounded by foliage.

Of the original details of the Exterior it is nearly impossible to form anything like a correct idea. The whole was greatly decayed at the commencement of the last century, and was recased, almost throughout, with Oxfordshire stone by Sir Christopher Wren and his successors; the details being altered and pared down in a very merciless manner: the work, *thus renewed*, has now again become greatly decayed. There is, in fact, scarcely a trace of any original detail of the Eastern portion of the Exterior left. The modeller employed by Sir Christopher Wren seems to have had more respect for the details than his master; for, while the latter destroyed the external shafts of the windows, and represented their capitals by huge ungainly *acorns*, the modeller has in several instances copied the originals quite faithfully.

The Exterior is thus described by Keepe in 1683. "On the North side you rather behold the skeleton of a Church than any great comeliness in her appearance, being so shrivelled and parcht by the continual blasts of the Northern winds, to which she stands exposed, as also the continual smokes of the sea-coal which are of a corroding and fretting quality, which have added more furrows to her declining years, that little of her former beauty now remains. On this side is a most noble door or portal, with a porch thereunto that opens into the cross of the Church, and on each side thereof two lesser porticoes, one of which only serves at present for the convenience of entering therein. This porch in former times hath been of great esteem and reputation, assuming to itself no less a name than that of the porch of Solomon. That it hath been a curious, neat, and costly porch in foregoing times, the

remains thereof do at this day in some measure declare, for therein were placed the statues of the Twelve Apostles at full proportion, besides a multitude of lesser Saints and Martyrs to adorn it, with several intaglios, devices, and fretworks that helped to the beauty thereof. But that it came in any proportion to the stately, rich, and noble porch of King Solomon, is not to be imagined; nor can we think that those who christened and gave it that name were so ignorant or so vain as so to believe; but as a thing excellent in those times, and far surpassing any of the same kind, it was looked upon as a piece of work well deserving no common name, and therefore had the title of Solomon's porch appropriated thereunto."

Crull, writing in 1711, says:—"The very remnants which are obvious to our sight even to this day, may soon convince us of its ancient beauty and magnificence. For this portico still retains entire below two of these admirable statues, besides two others quite defaced, and two more over the Eastern part of the portico, and as many over the Western door, through which you enter on the North side, pretty entire, being all undeniable witnesses of their former excellency."

These magnificent Portals formed, beyond a doubt, the most sumptuous external features in the Church, and should be especially mentioned as another imitation from French Cathedrals. It is curious that this is, so far as I am aware, the only instance in which those glorious portals, so common in France, were directly imitated in an English Church. From the existing remains, as well as from the above description, it is evident the portals must have been gorgeously rich. There are a number of mouldings still existing in the original stone, which clearly contained rich foliage, (like that still remaining in the doorway to the Chapter House,) now *carefully cut out.* The places where the figures of the Apostles stood are readily to be distinguished; and an old print shows one also on the central pillar of the double doorway, no doubt a figure of Our Lord. The tympana of the smaller openings retain their original stone, which is decorated with circular panels, no doubt once containing sculpture; but the great tympanum is renewed apparently without any regard to the original form. There were formerly gabled canopies to each portal; but now the central one has an ogee canopy, and the others none. The whole of this once magnificent front has been *wretchedly tampered with;* and even the design of the Rose Window is altered from the form shown in the old prints to one of miserable poverty. Dart, writing in 1723, says:—"This stately portico is now lately beautified, the time-eaten sculpture and masonry pared away, the *Gothic* order justly preserved, and the whole adorned with a magnificent window designed by the ingenious Mr. Dickenson, the surveyor of the building." I should mention that the name of "Solomon's Porch" was, I believe, really applied to a large porch erected against the central portal in the reign of Richard II.

It is a question on which much difference of opinion exists whether a Central Tower was ever contemplated. This feature was nearly universal among the great English Churches of the period; but, as this Church was designed on a French type, and as the Churches of the period in France very seldom have Central Towers, it seems most natural to suppose that it was not intended to erect one here. On the other hand, Sir Christopher Wren distinctly states that the commencement of a Tower existed in his time; indeed, in one of Hollar's views there are clear indications of it, and internally it is evident that the centre was not intended to be vaulted at the level of the Nave and Choir. M. Viollet-Le-Duc also seems to think that even in France this feature had often been contemplated; so that it seems there is as much to be said on one side as on the other. I cannot, however, think that the comparatively slender piers at the Crossing (to the extreme beauty of which I should have especially called attention), could have been intended to carry, at the most, more than a very light structure. Even at Salisbury, where the piers are far more massive, the lower story of the Tower is

very lightly built, and clearly without any intention of supporting the enormous superstructure which has since been added; and under the weight of which it has become terribly crushed.

The Cloisters were carried by Henry III. and Edward I. each as far only as his respective portion of the Church extended. The part built by Henry III. occupies a very singular position; being, in fact, within the walls of the Church, and forming a lower story to the Western Aisle of the Transept. This, as I conceive, arose from the position of the Cloister being determined by the older works, and the Church of the Confessor having had no Western Aisle to its Transept. King Henry, however, built the Eastern wall of the Cloister a few bays further than the Cloister itself, for the purpose of forming Entrances to the Chapter-House and Dormitory. Edward I. afterwards carried on the North wall of the Cloister just as far as he built the Church itself. The other bays of that side were built late in the fourteenth century, in imitation of the older bays; an almost solitary instance of the style of one period being absolutely copied in a later work. We find here at the corner, where they resumed the style of their own period the singular anomaly of an Early English and a Perpendicular Capital carved on the same block of stone, with their mouldings intersecting. The late imitators seemed to have been sorely puzzled with the detached Cuspings in the old circles, and to have made some very awkward attempts at reproducing them. The Doorway from the Church next the Cloister is a very fine work, but in a lamentable state of decay. The Window openings of the early parts of the Cloister have been glazed in their traceried heads only; the glazing being stopped upon a horizontal iron bar grooved at the top to receive it, and running along the springing line of the arch. This system was continued in the later work; indeed, it was the customary mode of dealing with Cloister openings: those at Salisbury, Canterbury, and Gloucester, works of very different periods, were, I think, all glazed in this manner.

In the Church we have no Windows of more than two lights, so that the tracery is in its most normal form. In the Cloister, however, the Windows are of three lights, and the tracery is not only in circles, but in quatrefoils and trefoils; while in the Chapter-House, there were Windows of four and five lights, showing that the principle of window-tracery had been brought to a considerable state of development.

In all the circles of the tracery, in the Church, the Cloister, and, no doubt in the Chapter House, the Cusping was, according to the custom of the period, worked separately, and fitted there into grooves in the reveals of the tracery, while the heads of the lights are almost always left uncusped; the Chapter-House forming, I think, nearly the sole exception. One feature, more French than English, is the great width of the Lights, generally between 4 and 5 feet, which must have afforded a noble scope to the glass painter.

We now come to the Chapter-House. Matthew Paris, under the date of 1250, after stating that the King had rebuilt the Church, says, "*Dominus Rex ædificavit Capitulum incomparabile.*" I judge from this that he commenced it during that year. It was, indeed, an incomparable Chapter-House! That at Salisbury was not yet commenced; and though evidently built in imitation of this, with some features of greater richness, it still must have yielded the palm to its prototype. Its beauties, however, are unhappily now for the most part to be judged rather by imagination than by sight, for seldom do we see a noble work of art reduced to such a wreck! It appears that, as early as the days of Edward III. (certainly before 1340) it was made over (I suppose occasionally) to the uses of the House of Commons, on condition that it should be kept in repair by the Crown. In or after the reign of Edward VI., however, St. Stephen's Chapel being given up to the House of Commons, the Chapter-House was converted into a Public Record Office. In or about 1740 the vaulting was found

to be dangerous, and taken down; and before this, in 1703, we find that Sir Christopher Wren having refused to put up a gallery in it, it was made over to the tender mercies of some barbarian, who fitted it up for the Records, with studious regard to the concealment or the destruction of its architectural beauties.

I undertook, some years back, the careful investigation of its details, when such was the difficulty presented by the fittings and other impediments, that, though every possible facility was afforded me by the gentlemen in charge of the Records, it occupied me (on and off) for several months. I believe, however, that I succeeded in getting at nearly every part of the design. The Internal view which I exhibit was founded on the result of my examination; and I think all will agree that a more elegant Interior can scarcely be found. The diameter of the octagon is about 58 feet, and the height to the crown of the vaulting about 54. The diameter of those at Salisbury, Lincoln, and York seem all to be nearly the same; probably the polygons were in each case inscribed in a circle of about 60 feet diameter, measured in the clear of the vaulting shafts. The central pillar still remains, and is about 35 feet high. It is entirely of Purbeck marble, and consists of a central shaft, surrounded by eight subordinate ones, attached to it by three moulded bands. The capital, though of Purbeck marble, is most richly carved. On the top is a systematically constructed set of eight hooks of iron for as many cross-ties. The same was the case at Salisbury, and I have no doubt that many of the hooks on the columns in the Church are original, and were intended for security during the progress of the work. The Windows are almost entirely walled up, but a considerable part of the tracery, no doubt remains imbedded. Their design is, however, readily ascertainable. One of them is a blank; one face of the octagon being in contact with the Transept of the Church. Nobler four-light Windows could hardly be found.

The Window over the doorway is most carefully walled up with ashlar, but from the bases visible on the sill, we see that it was of five instead of four lights—no doubt to avoid the stumped appearance it might have from being shortened by the height of the doorway, and the abutting Vestibule. I had often wondered that, while the Windows generally are walled up with *brick*, this should be filled with *stone;* but on taking out one of the ashlar stones to ascertain the section of the jamb, what was my surprise at finding them to consist entirely of lengths of the moulded ribs of the lost vaulting, carefully packed, like wine bottles in a bin; the moulded sides inwards. I made a still more interesting discovery in the Spandrels of the doorway below. The gallery crosses the head of this doorway, and the presses for the Records were fitted so closely to the wall that nothing could be seen. Being on the top of one of these presses, and venturing to pull away an arris fillet which closed the crevice between it and the wall, I perceived the top of an arched recess, and on looking down into it I saw a round object of stone. Having let down a small bull's-eye lantern, I saw that the mysterious object was the head of a full-sized statue in a niche, which proved to be a very fine one of the Virgin; and in the spaces adjoining there were Angels censing. I afterwards found that it formed part of an Annunciation; the Angel having been on the other side of the door. This last-named figure had, however, been long since removed into the Vestibule. Its wings are gone; but the mortices into which they were fixed remain. Both are fine works, though not devoid of a remnant of Byzantine stiffness.

The Doorway itself has been a truly noble one. It was double, divided by a single central pillar and a circle in the head, whether pierced or containing sculpture, I have been unable to ascertain, as it is almost entirely destroyed. The jambs and arch are magnificent. The former contain on the outer side four large shafts of Purbeck marble. Their Caps are of the same material, most richly carved; and the spaces between the shafts are beautifully foliated. The Arch contains two

orders of foliated mouldings, one of which, on either side, displays a series of beautiful little figure in the intervals of the entwined foliage. To get at some of the details of this doorway I had to creep on a mass of parchments and dust 10 feet deep; and, after taking out the boarding of the back of the cases, to examine and draw, by the help of a little bull's-eye lantern,—a most laborious operation.

The Walls below the windows are occupied by arcaded Stalls with trefoiled heads. The five which occupy the Eastern side are of superior richness and more deeply recessed. Their Capitals, carved in Purbeck marble, are of exquisite beauty. The Spandrels over the arches are diapered, usually with the square pattern so frequent in the Church, but, in one instance, with a beautiful one of roses. One of the most remarkable features in the Chapter-House is the painting at the back of these Stalls. The general idea represented appears to be Our Lord exhibiting the Mysteries of the Redemption to the Heavenly Host. In the central compartment, Our Lord sits enthroned: his hands are held up to show the wounds, and his chest is bared for the same purpose; above are Angels holding a curtain or dossel behind the throne; and on either side are others bearing the Instruments of the Passion. The whole of the remaining spaces are filled by throngs of Cherubim and Seraphim. The former occupy the most important position and are on a larger scale. In the two Niches, to the right and left of the central one, are two Cherubim nearly of human size. They occupy the centre of the niches, and with their wings nearly fill them: their heads are of great beauty, very perfect, and apparently painted in oil. They have each six wings, two crossing over their heads, two spreading right and left, and two crossing over their knees. The prevailing colour of the wings is blue—the symbolical colour given to Cherubim—and the feathers have eyes like those of the peacock, to carry out the description, "full of eyes within." One of the principal Angels holds a crown in each hand, and the other a crown in one hand, and something like a gem with two depending strings in the other; symbolising the rewards of heaven purchased by the Redemption. On one of them the names of the Christian virtues are written on the feathers of the wings, *e.g.*, officii sincera plenitudo; voluntatis discretio; simplex et pura intentia; munditia carnis; puritas mentis; confessio; satisfactio; caritas; eleemosina; orationis devotio; simplicitas; humilitas; fidelitas, &c. &c. In the outer niches are several Cherubic figures of smaller size, their faces strongly expressive of sorrow at the wounds of the Saviour; and in the background above, and the foreground below, are throughout a multitude of Seraphim, whose prevailing colour is, as usual, red. All the figures have gilt nimbi of rich patterns. The whole is executed in a highly artistic manner, and though the features are in some cases not quite consistent with the idea of Angelic beauty, the expression is very striking. I imagine the painting to have been executed about the middle of the fourteenth century; an opinion which is, I find, the same as that arrived at by Sir Charles Eastlake. In some other parts of the arcade are paintings of a very inferior character and of much later date. They represent the earlier scenes in the Apocalypse. I have not noticed any merely decorative painting, excepting in the heads of the five principal Stalls, which are coloured and gilt.

The Chapter-House is approached from the Cloister by an Outer and an Inner Vestibule. The former is entered by a magnificent Portal in the Cloister. It is a double doorway, the outer arch of two foliated orders; one contains in the entwined foliage a series of figures forming a Radix Jesse. The tympanum is exquisitely decorated with scroll-work: it formerly contained a sitting statue (probably that of the Virgin and Infant Saviour), under a niche, supported on both sides by Angels, which yet remain; the more perfect of which is very beautiful. This doorway was magnificently decorated with gold and colour, traces of which are still clearly visible. It is in a most lamentable state of decay, but I have, I trust, arrested the progress of disintegration by a process which I am making use of throughout the Interior of the Church, and which has already been applied to the wall-

arcading and the Triforium, as well as to the majority of the Royal Monuments. Its effect is to harden and set the crumbling surface, so as to stereotype the work in its present state. The surface is so tender, that we cannot venture to touch it before the operation is performed; we therefore merely blow away the dust with a pair of bellows, with a long flexible tube and nozzle, and inject the solution (shell-lac in spirits of wine) with a syringe perforated with a number of small holes.

The Outer Vestibule is exceedingly low, because the Dormitory passes over it to effect a communication with the Church. It is vaulted in two spans, supported by small Purbeck marble columns. The Bosses of the vaulting are of great merit. The vaulting was, till recently, mutilated, to allow of a Staircase to the room above, now the Library; but on discovering and restoring the ancient Staircase, which I shall presently mention, I was able to replace this vaulting, and to remove a brick wall which divided the Vestibule in its length, and inclosed the marble pillars. On the side which had been enclosed, the ancient paving remains deeply worn by the feet of the monks.. From the Vestibule there are doorways on either side, one into the Old Revestry of the Church (now walled up), and the other into a curious chamber, which I shall hereafter describe. At the further end of the Vestibule a second doorway leads into the Inner Vestibule, which is very different in design. Being free from the depressing cause before mentioned, it rises to a considerable height, and contains a flight of steps occupying its whole width, and leading to the great portal of the Chapter-House. It is vaulted in one span, divided into two unequal bays, one of which contained a remarkable Window, now destroyed; but, by cutting into the walls, I have been able to gain some clue to its design. On the opposite side are two Windows, now walled up, which gave a borrowed light to the Altar in the Revestry, erroneously known as the Chapel of St. Blaize.

The Floor of the Chapter-House is probably the most perfect, and one of the finest Encaustic Tile pavements now remaining; having happily been protected by a wooden floor. I have thoroughly examined it, and found it to be arranged in parallel strips from East to West; the patterns changing in each strip, though repeated on the corresponding sides. Many of them are most noble in their design, and some have extraordinary delicacy and refinement. Uniformity is in one place disturbed by the insertion of a number of tiles containing figures, such as St. John giving the ring to the Confessor, &c. Many of the patterns have been pretty correctly copied by Mr. Minton in the pavement of the Temple Church; and many are given by Mr. Shaw in his recent work on "Encaustic Pavements."

Of the External details of the Chapter-House, scarcely a trace remains; decay and mutilation having brought their work to a completion. Nor am I aware of any old prints or description which would aid in the recovery of the design.*

The Records are now in a great measure, and they soon will be, entirely removed. Let us hope that the Government will recollect the condition of five centuries back,—that they should *keep the building in repair*,—and that they will give it up to the Chapter, with a Restoration Fund proportionate both to the extent of the dilapidations and the merits of the building. I have omitted to mention that the Chapter-House is raised on a Crypt, which is vaulted like the superstructure on a central pillar. This pillar is round, and is carefully hollowed out at two stages, as if for the concealment of valuables. The Crypt contains a recess for an Altar, with a Piscina, a Locker, and the marks of a Screen. It was filled up some feet with earth, but I have lowered this to the original level.

I mentioned just now the two doorways which open (or once opened) from the Outer Vestibule, and the chambers into which they led. One Chamber is now mistakenly called the Chapel of St. Blaize; but in the older accounts it is denominated the Old Revestry. It occupies a space very

* Since writing the above, I have observed from the window of a neighbouring house a small portion of external tracery.

frequent in Abbeys, between the Transept and the Entrance to the Chapter-House, and often called by the expressive name of "the slype." It is little known by visitors to the Abbey; but it is a most picturesque, and, I think, beautiful room; and the skill shown in rendering so irregular a space sightly, and in vaulting it methodically, is very remarkable. Its main approach (now the only one) is the doorway in the centre of the South Transept. This doorway, we are told by Dart, was "closed with three doors, the inner cancellated, the middle, which is very thick, lined with skins like parchment, and driven full of nails. These skins, they, by tradition, tell us were some skins of the Danes tanned, and given here as a memorial of our deliverance from them. The doors are very strong, but were, notwithstanding, broken open lately, and the place robbed." Of these doors only one now remains; but we see the marks of the others. The offensive custom of lining the doors of sacred Treasuries with leather, made, not, I conceive, from the skins of Danes, but from those of persons executed for sacrilege, was, no doubt, intended as a means of terrifying less hardened depredators; but it was not always effectual.

As this Chamber is lofty, and intervenes between the Dormitory and the Church, it was necessary to provide means for the monks to cross it, to get to their nocturnal services. This was effected by a kind of bridge at the West end of the Chamber, in which the doorways are still visible which led into the Dormitory and into the Church; in which latter there was a detached winding staircase in the corner of the Transept, where Roubillac's monument to the Duke of Argyle stands. It is shown in all the old plans, and was probably removed to make room for that monument. The Western division of the Chamber was clearly the Vestiarium. It had in Dart's time, "a set of cranes of wood, swinging as if in a rack, on which formerly the copes and vestments in common use were hung."

There remain still, or did lately, in a forsaken Vestry at Aylesbury Church, racks of a similar description. In the Triforium there is a quadrant-shaped cope-box, probably belonging to the Revestry. There are several Aumbreys in the walls. The Eastern portion was, however, clearly a Chapel; indeed, the Vestries of our old Churches were generally Chapels, as is shown by the Piscinæ, almost always, and the Altars, occasionally, remaining in them. The Altar step, and some traces of the lower course of the Altar still remain. The former has a curious semicircular projection in its centre.

Over the Altar a full-length figure still remains painted on the wall. It represents a female crowned, holding a book in one hand, and carrying in the other what appears to be a gridiron. Immediately below there is a small painting of the Crucifixion, and on one side there is the figure of a monk in the attitude of prayer, proceeding from which, in the direction of the principal figure, are the following lines:—

"Me, quem culpa gravis premit, erige Virgo suavis;
Fac mihi placatum Christum, deleasque reatum."

Whether the "culpa gravis" was a disregard of the human hides placed, *in terrorem*, upon the door, and this painting was the penitential offering of a pilfering monk, I leave others to judge. I have not been able to discover what Saint the figure represents, nor the meaning of the badge which she wears. It is on the whole fairly drawn, though unduly elongated; and it appears to be painted in oil. To the South of this Altar are the borrowed lights from the Inner Vestibule of the Chapter House, already mentioned; the adaptation of the vaulting to suit these windows is exceedingly skilful and elegant. This most interesting room has, unhappily, been long used for the reception of all sorts of lumber, to its great disfigurement and injury. It was here that the Ironwork, torn down from the Royal Tombs at the time of the Coronation of George IV., was deposited. Of this I have had the happiness to restore a considerable part (belonging to the Tombs of Queen Eleanor and of Henry V.) to its place, but some yet remains behind.

The other Chamber is a very different one. It is a low vault, forming an imperfect portion of one of the bays of the Confessor's work, already described, and containing a portion of one of the Saxon columns. Within it, however, is a separate structure of less early date, long used as a wine-cellar! This inner structure is built up to the old vaulting, but it has a low sloping covering of stone. When I first entered this place I was much perplexed to know its purpose; but, after consideration, it occurred to me that it was the substructure of the original Stairs to the monks' Dormitory; an idea which agreed well with the existence of a walled-up doorway opposite to it in the Cloister. About the same time I happened to notice in the manuscript Lives of the Abbots, preserved in the Library, that one of them (Abbot Byrcheston) was said to be buried opposite to the Vestibule of the Chapter-House, and near to the Entrance to the Dormitory; a definition of their relative positions which at once confirmed my opinion, and at the same time pointed out a walled-up doorway, close to the portal of the Vestibule, as having been the Entrance to the Dormitory. I obtained leave to make an opening in the wall by which the doorway was blocked up, but my examination was at first impeded by the space within being filled completely up with dry rubbish. After taking out some cartloads, we came to the sloping platform, from which, however, I was disappointed at finding that the steps had been removed; excepting a portion of the bottom one, which was of Purbeck marble, and still remained in its place. The sill of the doorway was worn deeply by the feet of the monks, and more so on one side than on the other; showing that only one leaf of the door was generally used. In the dry rubbish there were many interesting fragments; among them some embossed and coloured mouldings, like those in S.. Stephen's Chapel. This Staircase now forms, once more, the Entrance to what was the Dormitory, but is now the Library. On the inner side of the door, in the Chamber underneath, I found hanging beneath the hinges some pieces of white leather. They reminded me of the story of the Danes' skins; and Mr. Quekett, of the College of Surgeons, I regret to say, pronounced them to be human. It is clear that the door was entirely covered with them, both within and without. I presume, therefore, that this room, too, was a Treasury, and that it formed part of, and its door was the entrance to the Pyx Chamber. It is possible that, after the robbery before alluded to, the King, finding that the terror of human skins offered no security, remodelled the Chamber; and intrusted the safety of his Treasury to the less offensive, but more prosaic defence of massive double doors, and multitudinous locks.

I have one more tale about this Chamber of mystery. There is between the wall which carries the stairs and that of the Chamber itself a long and very narrow interval. On first going along this crevice, some ten years ago, I found the floor covered several feet deep, apparently with stones and rubbish. Finding it spring beneath my feet, I stooped down and cleared away a little of the rubbish, when, to my astonishment, I found that I was standing on a large heap of parchment Rolls! It proved, however, less of a find than I at first expected, for it consisted, mainly, of packets of ancient Writs from the Courts of Justice; interesting only from their age, which varied, I think, from that of Edward III. to Henry VII. There were, also, a number of fragments lying about of little turned boxes of wood. I was prevented examining further at that time; while, however, preparing the present paper, I again obtained admission, when, to my surprise, I found the parchment heap still where I had left it in 1849. I examined it, and succeeded in turning up a number of the little boxes of which I had before seen only the fragments. I found them to be turned in poplar, or some other soft wood, not unlike ordinary tooth-powder boxes, but a little larger; the covers sewed on with a leather or parchment thong; and on the underside a few words describing the contents. Each contained one or more little parchment deeds, with seals affixed. They seem all to relate to the affairs of private individuals; and their great interest is in the earliness of their dates, which vary, so far as

I have ascertained, from the time of Henry III. to that of Edward III. Many of them are in a perfect state of preservation, in fact, as fresh almost as when new, and beautifully written; the Seals often very good. Amongst the parchments were lying fragments of Encaustic Tiles, of beautiful patterns, similar to some of those in the Chapter House, with the glaze so fresh as to lead me to think they had never been trodden upon.*

The next work in date to that of Edward I. seems to have been the rebuilding of the Refectory, and the completion of the Eastern Walk of the Cloister. Of the former I can find no record. The windows and doorway are of good Middle Pointed character; but of the latter we have a full account in the Fabric Rolls, showing that it was erected in and about the year 1345, by Abbot Byrcheston. It comprises the rich vaulting over the outer portion of the Chapter House, with the very remarkable window opposite to it, and the adjoining bays as far as the end of this side of the Cloister. The vaulting of the principal bay was richly decorated with gold and colour; and the central Boss retained at the commencement of the present century the pulley for raising a light in front of the Chapter-House door.

The completion of the Cloister was commenced in 1350, by Abbot Langham (afterwards Archbishop and Cardinal), and proceeded slowly but regularly throughout the whole of his Abbacy. It was completed by his successor, Abbot Litlington, in 1366, under whose direction, indeed, while Prior, the previous works had been carried on. We have here, again, a period of architectural transition. Byrcheston's work of 1345 is the purest Flowing Decorated; but the remainder is very Early Perpendicular; so far as we can see, for the tracery is gone from the Southern or earlier range. This side we know was in hand in 1355, and one of the two doorways in it (I think the smaller) was inserted in 1358; but even taking the year in which it is distinctly stated to have been completed, 1366, we have a remarkably early date for work distinctly Perpendicular in its character, though of very superior character, and very elegant in its mouldings.

During the reigns of Edward II. and III, it does not appear that the rebuilding of the Church was proceeded with; indeed, we find many entries of small sums expended on repairing its windows, &c., and on whitewashing the interior of the old Norman Nave. During the reign of Richard II., however, the rebuilding was continued. We find entries of the cost of breaking down the old walls, and considerable outlay for stone, marble, labour, &c., showing that the work proceeded vigorously. About the same period—indeed, commencing in the latter part of the previous reign—most extensive works were carried on in the monastic buildings. These were for the most part paid for out of a bequest, and, perhaps, out of previous gifts from Cardinal Langham; who, as we have seen, had been Abbot, and had made the fabric of the Abbey his residuary legatee. The works in question were carried out by his very active successor, Abbot Litlington, in whose time were erected, besides the South, the West, and the remainder of the North Walk of the Cloister (which had been commenced in Langham's time), the Abbot's House, including its hall and great chamber (the former now used as a Dining-hall for the King's Scholars, the latter well known as the Jerusalem Chamber), the Sacrist's, Cellarer's, and Infirmarer's houses, and a number of other buildings. From this time the Nave slowly progressed till the dissolution of the monastery; the West window being finished by Abbot

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* Since the above was written, the whole mass of parchments, &c., has, by the direction of the Dean, been carefully removed into the Abbey Library, where they will be duly examined and cared for. The lower part of the heap was one mass of decay. I have no doubt that they had in former times been carefully stowed away in the space below the Dormitory stairs, but had been turned out when this was converted into a wine-cellar (from the dates of the lots of wine chalked up over the bins) at least sixty or seventy years back.

Estency in Henry VII.'s time, and the Western Towers left unfinished by Islip, the last Abbot worthy of the name. The most remarkable characteristic in these later works is their continuing the general design of the earlier portions; not copying their details, as was done in the Cloister, but applying details of their own period to the general forms of the preceding age. So that, to a casual observer, the building presents throughout its Interior a homogenous appearance.

There is one part of the Interior of the older portion of the fabric which I have not yet more than cursorily alluded to,—I mean the Gallery in which the Archives of the Church are kept. It occupies the space above that portion of the Cloister which occupies the Western Aisle of the South Transept. It is approached by a door opening on the roof of the Cloister to the South of the Transept. The first bay we enter has from an early period been inclosed by timber partitions, plastered over to form a room for the more important muniments. On this plastered partition is a large outline painting of the White Hart, the badge of Richard II., showing the early date of the obstruction; but the other two bays form a Gallery or upper Aisle, open to the Church. The details of the upper portions of the Aisles may be advantageously studied from this Gallery; and, on its own account, it is worthy of a visit. The shortened columns—that is to say, the parts of them which rise above the gallery—are treated as entire pillars with bases of their own, presenting a singular contrast to the lofty proportions to which the eye has become accustomed. The views into the Church from this Chamber are picturesque and beautiful in the highest degree. Its contents are highly interesting, consisting of a number of large oak Chests in which the Muniments are deposited. Several of these are evidently of the thirteenth century, and are very curious. There is a handsome trunk of later date in the inclosed space, containing the original indentures of Henry VII.'s Chapel, being agreements with, I think, nineteen different parties, Abbots and other authorities, binding them and their successors to see that the rules of his foundation are carried out; but the long-headed King was not wise enough for his generation, for his own bluff son cut the ground from under him, by abolishing the offices which he had made responsible for the performance of his injunctions. I have no doubt that the contents of these ancient coffers would throw much light upon the Architectural history of the Abbey. The particulars I have given of the works from the time of Edward III. onwards, were, by the permission of the Dean and Chapter, extracted a few years since from the Fabric Rolls by my able friend, Mr. Burtt, of the Record Office, and have been communicated to me while this paper has been in hand.

Several of the Chests in the Pyx Chamber so closely resemble those in the Muniment-Room, as to make it evident that they also were made in the thirteenth century, and even by the same men. There is, in the Pyx Chamber, another of the same date and of higher finish; it contains dies of Mediæval coins, and has ironwork of very good character. Others are of different subsequent dates; one of them, made of oak and covered with leather, is very much like that of Henry VII., just alluded to; another is made of deal, and thickly plated with iron. There is among them a very curious leather case, strapped with iron, and stamped all over with fleurs-de-lis, exactly agreeing with descriptions of the cases of ancient documents given by Sir Francis Palgrave. There is also among them another curious leather case, apparently to receive a vessel of some kind.

Having now gone generally through the Fabric, I will next advert briefly to some interesting documentary information from the Public Records, which has quite recently been communicated to me by Mr. Burtt.*

I am aware that the details of Antiquarian documents are not well suited to a meeting like this,

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* Of the kindness of this gentleman I cannot speak too strongly. While my paper was in hand, he gave himself infinite trouble in searching for notices of the works, and with very considerable success.

and I will, therefore, only advert to a few important points. The first of them is this. As Westminster Abbey is about the earliest work of its style in this country, and as the building of the first portion of it by Henry III. extended over a space of twenty-four years, *i. e.* from 1245 to 1269, it becomes important to ascertain how early in this period the style of its Architecture can be proved to have been defined. A single entry in the documents in question has for ever settled this point. I have before stated that the most advanced part of the work (as to style) is the Chapter House, as that contained traceried windows of four and five lights in a very developed form; the tracery not confined to circles, but containing great quatrefoils; and the heads of the lights being trefoiled, which is not the case in the Church, Now, it would be most useful to know the exact date of these windows; for, though Matthew Paris gives 1250 as the year of commencing the Chapter-House, the works may have spread over an indefinite length of time, and the windows have belonged to a period twenty years later. Let us look into the Bills. Here we find in a Roll, bearing date 37th Henry III., or 1253, and expressly called the eighth year from the beginning of the work, an item of "300 yards of canvass for the Windows of the Chapter-House," followed immediately by items for the purchase of glass; showing that the Windows in question were completed in 1253, which I see was the year before the King, in company with St. Louis, visited the Sainte Chapelle, at Paris, then scarcely completed; the style of which indicates exactly the same degree of advancement. I find also, that during the same year, the beautiful Entrance or Vestibule to the Chapter-House was erected.

The Church itself was by this time—indeed, as early as 1249—in a state of rapid progress, so that the Architecture must, in the main, have been quite settled from the time of its commencement.

The entries found by Mr. Burtt are, for the most part, of a somewhat general character; but it is stated in the Pipe Rolls, that further particulars have been sent in to the Treasury. These Bills of particulars have, it is feared, been, for the most part, lost; but Mr. Burtt has succeeded in finding a complete one for about half a year (probably 1253), which is of so interesting a character that there is no doubt that it will be published, with notes, by Architectural Antiquaries. It is a perfect Bill of Quantities of the work done during twenty-five weeks, giving the names and measurements of every moulding and every detail of the work, and it will form a very curious and interesting illustration of the Architectural Nomenclature of the period. Attached to it are two amusing little letters from the quarry-master at Purbeck, promising shiploads of marble, and begging for speedy orders on the ground of other pressing business. The notices I have adverted to in the Fabric Rolls of the works from Edward III.'s time onwards, are also very detailed, and give curious particulars as to the mode of employing men at that time. They appear to have been fed and clothed by the employer, and the clothing would appear to be by no means to be complained of. In one year we have an entry of 15s. (equal to 8*l.* or 10*l.*) for a fur robe for the chief mason; but in another year nothing is entered for his robe, because this independent gentleman "refused to receive it on account of the delay in its delivery."

Going back to the earlier accounts, I may mention that extensive works appear to have been going on at the same time in the Palace and its Chapel, including a great deal of decorative painting; also that the Belfry of the Abbey was being built, which, I think, stood somewhere Westward of the Church, and of which, I believe, remains existed at a somewhat recent date. The outlay upon the Abbey during the first fifteen years of the work would, if translated into our money value, considerably exceed half a million!

I have dwelt so long upon the Fabric that little time remains for any notice of the Internal contents of the Church. Indeed, they would be more worthily treated of in a distinct paper. I will content myself with a cursory notice of a few to which I chance to have paid particular attention. That most remarkable work, the Shrine of the Confessor, was so largely dwelt upon before this

Institute, when the subject was brought forward a few years back by Professor Donaldson, that it would be superfluous to go again into the minutiæ of the investigation, to which I devoted a great amount of time, and which was ably followed up by my talented friend Mr. Burges.

I will content myself with a summary of the results. Shortly after my appointment to the Abbey, in 1849, I was led, in consequence of a visit to the Church by Le Père Martin with myself and some members of the Ecclesiological Society, to devote a good deal of attention to ascertain, so far as was possible, the ancient form of the Shrine; the results of which I gave in a correspondence with a leading member of that Society. Having removed the brick wall which then blocked up the West end, and exposed the marks showing where the Altar had been fixed, I came to the conclusion that the Pillars now at that end were formerly detached, and carried lights. Probably they were the "feet" which Henry III. is said to have given for certain lamps to be burned before the Shrine.

The Retabulum occupies, as I ascertained, its proper position, excepting that it has been lifted 3 inches above its original level; a fact proved by its intercepting the space required for the completion both of the ancient and the more modern inscriptions, for neither of which there is now sufficient room.

The front and what is seen of the back of the Retabulum, being decorated with mosaic, and the edges left plain, it follows that the latter must have been more or less concealed. I judge, therefore, that the detached pillars must have been placed very close to them.

Mr. Burges has kindly lent me the sketch of his conjectural restoration, from which I only differ in doubting whether there existed more than two of the detached pillars.

Extracts have been kindly communicated to me, by Mr. John Gough Nicholls, from diaries kept during the days of Queen Mary, showing that the body of the Confessor had been removed, and the Shrine wholly or in part taken down at the Dissolution, but that it was restored in Queen Mary's time; when the present wooden Shrine, the cornice, the modern inscription and the painted decorations were added. I am inclined to think that the marble substructure was only taken down far enough to allow of the removal of the body, as its parts have been displaced in refixing so far down, but no further. The Altar either had not been removed or it was probably re-erected at the same time, and it was not, I think, removed again till the Great Rebellion; being needed at Coronations, on which occasions a table has since been substituted, under the old name of "the Altar of St. Edward." I found at the back of the place where the Altar stood, a slab, apparently taken from some monument of the seventeenth century, which confirms this idea. There is, in Abbot Litlington's service book in the Library, in the initial of the service for St. Edward's day, a view of the Shrine; but I fear it is an imaginary one. The substructure is speckled over to represent the mosaic work; but the seven arched recesses for pilgrims to kneel under, which really occupy two sides and an end, are all shown on one side! The Shrine itself is shown lower than was usual, with a recumbent figure of the Confessor on its sloping covering. I will only add that I opened the ground round the half buried pillars at the West end, and I found them to agree in height with those at the East, which they so much exceed in diameter; and that I have been so fortunate as to recover the broken parts of one of the Eastern pillars, and to refit and refix its numerous fragments with the help of one new piece only a few inches in length, so that we have now one perfect pillar.

In connection with the Shrine I will mention a discovery which I have shown to many, I dare say, now present. There is a sarcophagus-shaped slab in the floor, immediately to the East of the Shrine which is said to commemorate a son of William de Valence, who died young. The Cross and the Inscription are nearly obliterated, but its Eastern end is covered by the step to the Tomb of Henry V. A very pains-taking friend and assistant of mine (Mr. Irvine), in examining the point of junction between

the step and the slab, perceived signs of some substance being inlaid in the latter. I obtained permission to remove a portion of the step, when we found that the slab had been inlaid with brass and glass mosiac, no doubt, executed when the Shrine was in hand.

I am enabled by the kindness of Messrs. Minton to exhibit a tracing of a large portion of the pavement before the Altar, executed by Roman workmen, with materials brought from Rome by Abbot Ware, about 1267 or 1268. Of the curious inscription, a part, giving the list of those concerned in the work, is still legible, "Tertius Henricus urbs Odoricus et Abbas:" "Odoricus" being the artist, and "urbs," of course, meaning Rome, as is proved by Ware's own epitaph, which says, alluding to these stones, "quos huc portavit *ab urbe*."*

It is curious that both in the Monuments inlaid with glass mosaic, and in the Pavements in which the inlaid material is chiefly porphyry, the artists adopted Purbeck marble as the matrix, in place of the white marble they were accustomed to use in Italy.

The Tomb of Henry III. is too well known to need description here, but that of some of his children and grandchildren in the South Aisle is but little noticed; indeed, its Italian forms so much resemble those of a modern monument that it usually passes for one.

Taking the Tombs of the Confessor, of Henry III., and his daughter, and of young de Valence, in connection with the Pavement before the High Altar, and that of the Confessor's Chapel, I should doubt whether—I will not say any Church North of the Alps—but, I may almost say, whether any country North of the Alps contains such a mass of Early Italian decorative art; indeed, the very artists employed appear to have done their utmost to increase the value of the works they were bequeathing to us, by giving to the mosaic work the utmost possible variety of pattern.

Another object, which does not receive the attention it deserves, is the Retabulum from the High Altar, now preserved in a glass case, in the South Eastern aisle. It is a very wonderful work of art, being mostly richly decorated with glass, gold, and painting, and probably with precious stones, and even with casts of antique gems. The glass enrichments are of two sorts—in one the glass is coloured, and decorated on its face with gold diaper;—in the other it is white, and laid upon a decorated surface. The great charm, however, of the work must have been in the paintings. They consist of single figures in niches of our Lord and St. Peter and St. Paul, and two female Saints, and a number of small medallion subjects beautifully painted.†

Next to the Italian Tombs, one of the most interesting is that of William de Valence. I am not aware whether any old account of this monument exists, but I suppose we may fairly set it down as a French work, probably executed by an artist from Limoges; though the custom of referring all enamel works to that particular seat of the art is not, I think, borne out by facts; indeed, it would appear from the old accounts that enamels for the Shrine of the Confessor were executed here, whether by an artist from Limoges is unknown, though we know that one was employed in England shortly afterwards. The execution of these enamels is truly exquisite; so much so, that it is only by the closest examination that any idea can be formed of the wonderful delicacy of the workmanship.

The monument was thus described by Keepe in 1683:—

"A wainscot chest, covered over with plates of brass, richly enamelled, and thereon the image of de Valence, Earl of Pembroke, with a deep shield on his left arm, in a coat of mail with a surcoat, all of the same enamelled brass, gilt with gold, and beset with the arms of Valence, &c. * * * Round

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* This tracing was made many years ago for the late Mr. Minton, under my direction, by my then highly talented assistant, and now distinguished brother architect, Mr. Street.

† An excellent description of this work is to be found in Sir Charles Eastlake's "Materials for a History of Oil Painting."

about the inner ledge of this tomb is most of the epitaph remaining, in the ancient Saxon letters, and the rest of the chest, covered with brass, wrought in the form of lozenges, each lozenge containing either the arms of England or of Valence, alternately placed one after the other, enamelled with their colours. Round this chest have been thirty little brazen images, some of them still remaining, twelve on each side, and three at each end, divided by central arches that serve as niches to enclose them; and on the outward ledge, at the foot of each of these images, is placed a coat of arms in brass enamelled with the colours."

Since that time, the greater part of what is above described has disappeared; showing that the spoliation of the Abbey is not generally chargeable against the Rebels, but that it has gone on *in modern times* during the contemptuous dominion of *Classic taste.*

The Tomb of Queen Eleanor, with its exquisitely elegant effigy, is too well known to need any description. I have had the privilege, since my connection with the Abbey, of promoting the replacing of the beautiful piece of ironwork which overhangs it, which had been removed in 1821. The effigy, with that of Henry III., was executed by an artist named Torrell, supposed by Sir Richard Westmacott, I think, without evidence, to be an Italian. It is one of the finest which remains in any country.

Were this paper devoted to the Monuments alone, I should have attempted a description of the Tomb of Edmund, Earl of Lancaster, brother to Edward I., and of Aveline, his wife. These magnificent monuments, viewed as architectural works, seem to be intimately connected with several contemporary works, especially the Eleanor Crosses, and the Tombs of Archbishop Peckham, at Canterbury, and of Bishop de Luda, at Ely, all executed between 1290 and 1300. One of their special characteristics is the extreme closeness with which nature is followed in their foliated carvings, every portion of which is taken directly from some actual plant, with no further conventional treatment than was necessary to adapt it to its position. These works occupy the middle position between the conventional foliage of the *earlier* and the almost equally conventional foliage of the *later* divisions of our architecture. It is, in fact, a mistake to call the foliage, even of the later parts of the decorative style, *natural.* The use of really natural foliage is very seldom found after the end of the thirteenth and the few earliest years of the fourteenth century; and it marks, if I may say so, the resting-place between the conventionalism of *approach* to and the conventionalism of *departure* from nature; the conventionalism of strength and of weakness, of vigour and of lassitude.

But the most remarkable characteristic of the two monuments is the splendour of their decorative colouring.

The figure sculpture, though possessing considerable merit, is not so fine, either as in the nearly contemporary monuments of Henry III. and of Eleanor, or in the somewhat later one of Aymer de Valence. The effigy of Edmund is, however, a very noble and dignified work.

The adjoining Tomb of Aymer de Valence is evidently an imitation of those last described, but it does not equal them either in its Architecture or its decorations, though far exceeding them in the merits of its sculpture. I have seen no old accounts of this Tomb, but I fancy that the sculpture is French, both from a decidedly French character in the architectural carving of the niches which contain the statuettes, and from the similarity of the statuettes themselves to some of the same period preserved in the Hôtel Cluny at Paris. These, and the effigy itself rank among the finest specimens of Mediæval sculpture.

The Tomb of Queen Phillippa stands, perhaps, next to them in beauty and interest. It is undoubtedly a foreign work, as in the account of its cost, still extant, it is said to have been executed by one "Hawkin Liege, from France." Its character seems to me rather Flemish than French, and

very possibly the artist may have been from Valenciennes, the seat of her father's Court. The monument consists of an Altar Tomb of dark marble overlaid with niches of open work in white alabaster. These niches contained thirty statuettes of different personages, connected by relationship or marriage with the Queen. Nearly the whole of the tabernacle-work, though shown as perfect, in the prints of the early part of the last century, has since disappeared.

The end of the Tomb has been immured in the lower part of the Chapel of King Henry V. Thinking it probable that the tabernacle-work and statuettes might remain within the enclosing masonry, I obtained permission to make an incision into it, which I found could be done without injury to the later monument. I was so fortunate as to find several niches in a tolerably perfect condition, with two of the statuettes quite perfect, and a number of fragments of others. I found also in the tabernacle-work a most beautiful little figure of Angel with wings of gilt metal. The figure had lost its head, but I was so fortunate as to discover it enveloped in a lump of mortar. I found also enough of the architectural features to serve as a guide to the recovery of the entire design. Mr. Cundy, the Abbey mason, made, from the information thus obtained, a restored reproduction of the end of the monument, which he exhibited in 1851. One of the niches and several other portions were afterwards found to be deposited in Mr. Cottingham's Museum; and, having been purchased from him, they have been refixed in their places.

One very curious feature in the design is a scroll, like the crook of a pastoral staff, between the niches at the angles of the monument: the architectural details had no decorative colouring, but the foliage was gilt. The Arms were, of course, coloured, and the figures had beautiful patterns, chiefly in gold upon the draperies. The hair was gilt, the pupils of the eyes touched in with blue, and the lips with red; the head-dresses of the female figures beautifully enriched with gold and colour. One of the heads was unfortunately broken off in opening it out; for I should mention that the figures were inclosed in a solid mass of rubble work. I had a cast made from this head, and the decoration exactly copied on it. I had also a cast made of the angel before mentioned,—and most fortunate it was that I did so! I afterwards most carefully replaced them with my own hands, fixing them in their places with shell lac; but though I told no one I had done so, and though they were quite out of sight, I was disgusted to find, the next time I examined the monument, that both of them had been stolen! They were so difficult of access that this act of wanton depredation could only have been effected by a person *well acquainted* with what had been discovered, and that with considerable difficulty. It is most deeply humiliating to think that persons, capable of appreciating the value and interest attached to such objects, should be so utterly lost to all sense of honour and decency as to perpetrate such a deliberate robbery. I would not go so far as to flay this wretched being, as would, perhaps, have been done of old; but I should rejoice in the opportunity, according to the figurative expression still extant among our rural population, of witnessing the "tanning of the rascal's hide." If, however, what I have said should chance to meet his eye; let him know that there is still for him a *locus penitentiæ*, and that if he will anonymously restore what he has filched, his baseness shall be forgotten.

I should mention that the lost head is so like that of the Queen herself, that it is not improbable it may have been intended for her; though she does not appear in the imperfect list of statuettes given in the old histories. The open-work of the niches over the head of the effigy itself has been filled in with blue glass. The magnificence of the entire work may be imagined when it is known that it contained, when perfect, more than *seventy statues and statuettes*, besides several brass figures on the surrounding railing.

Somewhat parallel to this, both in material and workmanship, was the monument of John of

Eltham, brother of Edward III. I shall not enter into any description of this work, however, further than to advert to its beautiful canopy, which is thus described by Keepe :—

"A canopy covering the whole with delicate wrought spires and mason's work, everywhere intermixed and adorned with little images and angels, according to the fashion of those times, supported by eight pillars of white stone, of the same curious wrought work." This canopy is shown in Dart's view of the monument, but it was taken down about eighty years back, on the ground of insecurity. It has often been stated that portions of it were preserved at Strawberry Hill, but I have never been able to ascertain the truth of this. If any one should know of the existence of such fragments, I should be truly obliged by his informing me.

The original Stalls of the Choir seem to have been retained in a more or less perfect state till late in the last century. They are shown in the view by Dart, and in that given in Sandford's account of the Coronation of James II. The Canopies are shown supported by single shafts. I observed when the new Stallwork was being put up in 1848, that a closet under the Organ was lined with old boards which appeared to have formed a part of the back of the ancient Stalls; for I could distinguish, by the discolouration of the wood, the form of a trefoiled arch supported by a shaft with a band at half its height. At a later period, on looking into this closet, I was glad to see the boarding still there; but, on looking into it again while preparing this paper, I found that our careful Clerk of the Works had caused it to be neatly painted, so that this little memento is lost. There remains, however, in Henry VII.'s Chapel, one of the ancient Early English Misereres, and a fragment of another has been preserved. They both exhibit good Early English foliage.

There is a great fund of minor subjects, on which a separate paper could be very advantageously written, but I must leave them unnoticed on the present occasion. I have gone over my ground as rapidly as I could, but I have more than doubled the allotted time: Westminster Abbey, however, is at least worthy of an extra hour, and I will only add that I recommend all students of Gothic architecture to devote to it *every extra* hour they have at their command. London has been pretty much denuded of its Mediæval remains, but—like the Sibyl's books—those which remain are worth as much almost as the whole; and to live in a city which, amidst its gloomy wilderness of brick and compo, contains so glorious and exquisite a work of original art as this, is a privilege which few other cities can offer us.—*Let us make use of it.**

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* Among other things I should have given a description of the Coronation Chair, and of the figures remaining in the panels of the old Sedilia, commonly called the tomb of King Sebert. The former is a truly magnificent piece of decoration, but sadly mutilated. The decorations are somewhat peculiar; the whole seems to have been gilt on a thick coating of gesso, and while still soft, the foliage, &c., was traced upon the gold, and indicated merely by pricking the outline and the intervals between the leaves. Of the eight figures in the Sedilia two only remain perfect. They appear to have been slightly touched up, but are mainly original. They represent, I believe, King Henry III. and King Sebert. The figure of King Edward the Confessor, on the back, which is given by Malcolm, in his "Londinium Redivum," can now with great difficulty be distinguished. The painting in the Canopy of the tomb of Richard II. ought also to have been noticed. The diapered ground is still very perfect, but the painting of the figures has almost entirely perished.—The large contemporary portrait of Richard II., formerly in the Choir, but now preserved in the Jerusalem Chamber, and the fragments of early stained glass preserved in the same room, should also have been noticed.

SIXTY YEARS SINCE: OR IMPROVEMENTS IN BUILDING MATERIALS AND CONSTRUCTION DURING THE PRESENT CENTURY.

By G. R. Burnell, C.E. Read at the Royal Institute of British Architects, January 9th, 1860.

It has been said by philosophers and historians, that advantage is to be obtained from an occasional pause in the restless advance of our civilisation, and from a retrospective glance towards the starting point of our progress. If this be true in metaphysical or in historical science, there seems still less reason to question the applicability of the maxim to the more decidedly physical branches of study; and in them especially it must be advantageous to dwell occasionally upon the various lessons to be derived from past experience, or to derive hope and encouragement for the future, from the contemplation of the improvement already attained. At the present day there is also prevalent a disposition amongst the younger, and, perhaps, also amongst the more conspicuous elder, members of the particular branch of the architectural profession cultivated by this Institute, to treat the study of the practical details of their profession with indifference, and to dwell almost exclusively upon the æsthetical portions of their pursuit. A review, however slight, of the great changes effected in the mechanical arts of construction within the lives of some now present, or since the year 1800, may, therefore, have somewhat of the charm of novelty to many; at any rate the lessons it will afford must be fraught with instruction and interest to all, if properly handled. The particular date to which the review is limited, I would observe, has itself been selected with a definite purpose—viz., in order to allow us to trace the influence of the great revolution in men's minds, which marked the close of the eighteenth century, upon even the technical branches of sciences; for it is certain that any profound agitation of the higher faculties of the human mind must react upon every form in which human activity displays itself. Unquestionably the inhabitants of the civilised world have made greater progress, in their political and moral advancement, within the ast century, than they did in any corresponding period of the world's history, notwithstanding the faults and the crimes which have disgraced in turn almost every nation; and so also, to descend from this exalted moral sphere, to our own technical pursuits, do I believe that the mechanical arts have made similar progress, and that, especially since 1800, they have been developed with a degree of energy, and of success, of which mankind had no previous example.

Let us not, however, in starting be ungrateful to our predecessors. The wonderful progress we have been able to make, was in fact prepared by the researches of the philosophers and engineers of the earlier portions of the eighteenth century; and they who are curious in historical parallels may trace in the feverish energy, with which all classes of analytical and physical sciences were cultivated at those periods, the influence of the long peace of Europe, which followed the prostration of French power in 1713; and the still more direct influence upon English prosperity, which followed the conclusion of the civil wars in 1746. Such men as D'Alembert, Lahire, Borda, Bossut, Coulomb, Bouguer, Clairaut, Lacaille, Camus, Peyronnet, De Cessart, Rogemorte, Lamblardie, &c., in France; as Boyle, Cavendish, Black, Desaguliers, MacClaurin, Robison, Franklin, Maskelyn, Hutton, Watt, Wedgewood, Smeaton, Brindley, in England; Euler, Frisi, Brunnings, Bernouilli, Pallas, Ulloa, and countless other philosophers, mathematicians, and engineers, in Italy, Germany, and other countries, had labored earnestly and successfully, to advance the knowledge of physical and applied sciences. Works such as the bridges of Orleans, Nantes, Neuilly, Tours, the ports of Havre, Treport, Dieppe, the commencement of the great breakwater of Cherbourg, the erection of the Eddystone lighthouse, and the completion of the Bridgewater canal: or still more remarkably, the first steps in the application of the Steam Engine; were surely sufficient to entitle the engineers of the last century to our admiration

and respect. Fortunately for us, we have succeeded to a rich heritage, and we have reason to be grateful to our predecessors. But the natural law seems to have held in this case, as in most others—viz., that progress is accelerated by the mere fact of its own existence. "Vires acquirit eundo:" and I hope to show that the present generation of practical philosophers has done its duty in transmitting with increased brilliance the torch it received from the race which so honored the eighteenth century.

Perhaps the most simple and logical method of treating the subject before us, would be to trace the history of the improvements introduced into the separate branches of construction, *seriatim;* and, as far as possible, in their chronological order. I propose therefore to call your attention, first to the improvements effected since 1800 in the execution of foundations; secondly to the increased facilities for construction afforded by the introduction of new, and the more perfect study of the capabilities of old, building materials; and thirdly to the increased facilities afforded by the use of new tools and machinery. Of course no one man can pretend to know, or to be able to record, all that has been done in so wide a field; and I, therefore, at once beg you to excuse, and to supply the defects of this cursory review.

First: The researches of the geologists of the last century had called the attention of architects and engineers to the study of the strata upon which buildings were to be erected, and the drainage operations carried on by Elkington, had led some acute observers to question the correctness of the principles upon which many eminent practitioners then founded their buildings. About the middle of the last century, in fact, Labelye and De Cessart, had given a species of vogue to the method of founding in deep water upon caissons; and the same principle was adopted in executing the foundations of ordinary buildings erected upon soft, compressible ground; for about that period nearly all the buildings, for instance, erected in the marsh-lands near London were founded upon timber platforms, in preference (be it observed) to the use of piles, according to the custom of the Dutch. The first great improvement made in this particular branch of construction since 1800, seems to have consisted in the use of concrete, a substance well known to the Roman and to the Mediæval architects, but which had been neglected until Vicat's "experimental researches into the qualities of limes and cements," had again turned the attention of builders to the application of that class of materials. Vicat seems to have been one of the first persons to use concrete, on a large scale, in the foundations of the Bridge of Souillac, and in our own country, Sir R. Smirke and Mr. J. Rennie may be considered to have been the revivers of the use of this material. At the present day concrete has entirely superseded all the systems of timber platforms, and in many cases it has equally replaced the use of piles; that is to say, when the area of the bearing surface is very large in comparison with the weight to be supported, and the subjacent foundations are protected against the lateral displacement.

The introduction of the Parker's Roman Cement in 1796, had, to some extent, prepared the way for the use of what may be called monolithic foundation courses, such as were thus obtained by employing concrete. But the greatest advance in this branch of applied physical science was unquestionably due to Vicat, who first successfully expounded to the public, in 1818, the principles upon which the setting of lime depended. Since that period, other labourers have been in the field, and not only have the qualities of the various descriptions of natural limestones been carefully studied, but the manufacture of artificial hydraulic limes and cements has assumed an extraordinary degree of commercial importance. Sir C. Pasley, Messrs. St. Leger, Frost, Hamelin, Aspdin, Blashfield, and at a later period, Messrs. Minard, Kühlmann, White, and Francis, have in turn increased our resources of this description, and with such success have their labours been attended, that, at the present day, the artificial hydraulic limes, and the Portland cement have to a great extent superseded the use of the natural materials of those descriptions. Amongst the most remarkable instances of the application

of the Portland cement may be cited the foundations of the Westminster-bridge, the hearting of the Dover jetties, and the huge, artificial blocks laid upon the sea slope of the Cherbourg breakwater, to protect the small rubble of the central parts of that wonderful breakwater; and the principle upon which the use of concrete in foundations is based—viz., that of supplying a solid, homogeneous mass to receive the superincumbent weight, has, it may here be added, lately been applied in a still more striking manner; for the French engineers have actually constructed some bridges (such as the Petit Pont, the Pont aux Doubles, both of which have arches of about 104 feet span, and the Pont d'Alma, the centre arch of which is 141 feet span, with a rise of one-fifth) of small rubble, bedded in rapidly setting cements, upon the avowed theory that these arches would practically become huge monoliths. They trusted, in fact, to the adhesive powers of the cement, just as Mr. Brunel did in the construction of the Maidenhead-bridge; and they have succeeded, as he did, in accomplishing their object. The execution of the new graving dock of Toulon, entirely of ordinary concrete, poured into sea-water at least 26 feet deep, may also be referred to as an illustration of the boldness and skill of our neighbours in the use of this material, as well as of the great service it is susceptible of rendering, when it may be desirable to found structures in deep water. Unfortunately, the study of the properties of the various kinds of lime is not a favorite one in England, and it is, no doubt, to this peculiarity of our ordinary professional education that we may attribute the comparatively limited use made in this country of concrete as a material of general construction, and its exclusive employment in foundation works. Perhaps the explanation of the preference of cement for hydraulic limes, so common amongst our constructors, may be found in the same neglect of this important material.

The substitution of cast-iron piles and plates, for timber piles and sheeting, (of which instances may be observed in the wharf wall of the Blackwall railway station, the Adelaide wharf, and the Chelsea and Westminster bridges,) may be cited as an illustration of the application of that material to foundation purposes, at least in an indirect manner. But the greatest modifications lately introduced in this detail of construction were, firstly, those by the French engineers subsequently to 1816, in the manner of founding their bridges (by the use of close sheeting, the interior of which was then dredged out, and filled in with concrete), instead of the old and expensive method of forming coffer-dams—a method now almost universally exploded on the Continent, though, unfortunately, some of the leading engineers did not scruple to attack Mr. Page, with great personal bitterness, for introducing it in the New Westminster-bridge. Secondly, we may quote the application of Mitchell's screw piles, and the introduction of the Nasmyth and of other descriptions of steam pile-driving machinery. Thirdly, we may quote the introduction of Dr. Pott's system of driving hollow cylinders of metal for the purpose of forming, as it were, permanent masonry piles under the basement courses of a bridge. Fourthly, the idea upon which Coulomb in the last century based a system for executing foundations under water has been considerably modified and extended in the course of the execution of the new Rochester, Saltash, and the Strasbourg and Kiel Bridges. In these cases, large hollow cylinders were sunk through the moveable or compressible upper strata to the solid subjacent rock, by the application of machinery for the compression of the air in the cylinders themselves. Descriptions of these very remarkable works may be found in "Les Annales des Ponts et Chaussées" for May and June, 1859; in "Les Nouvelles Annales de Construction," November, 1858; in the Dictionary of Technical Terms of the Architectural Publication Society; and in a pamphlet by Mr. Hughes, which unfortunately was not published, upon the foundations of Rochester-bridge.*

* This pamphlet was, it may be observed, of the greater value from the fact that Mr. Hughes conducted that remarkably successful operation.

A fifth modification of the method of founding buildings upon compressible subsoils may be here mentioned. It consists in the use of a layer of fine sand, which is prevented from spreading laterally, and extends over the whole surface of the building. In fact, practically, sharp silicious sand is incompressible, for as its particles have usually as little cohesion as the molecules of a fluid, a weight brought upon one portion of the surface becomes distributed over the whole, if simply the weight be prevented from piercing the surface, and if the sand be prevented from moving laterally. This method of founding has been adopted in the execution of heavy embankments carried over peat mosses; and I have myself applied it in the erection of some extensive cotton warehouses on the alluvial lands near Havre.

Secondly: About the end of the last century, cast-iron began to be used for building purposes, and the execution of the Colebrook Dale, and of the Sunderland bridges, the former of which was completed in 1777, from the designs of Thomas Pritchard, and Abraham Derby, and the latter from those of Thomas Payne, in 1796. But the general application of this material appears to date from the period when Telford employed it in the construction of the Chirk and Pontycystle Aqueducts, the first stone of the latter of which was laid 25th July, 1795, and of the former, 17th June, 1796. Telford also, in 1796 commenced the construction of the Buildwas-bridge with an arch of 130 feet span; and subsequently the practical and theoretical investigations carried on in our own country into the properties of this material by such engineers as Telford, Rennie, Rastrick, Brunel, Stephenson, and by such physicians as Tredgold, Barlow, Navier, and lastly, by Willis, Mosely, Morin, and Hodgkinson, have admitted its application in the most varied manner, and on the largest scale, in the forms of girders, voussoirs, pipes of enormous size, railings, and ornamental decoration. The improvements in the science of metallurgy, have, indeed, contributed to bring cast-iron into almost universal use; but it is necessary to remark that the introduction of the hot blast in the smelting of iron, about 1831, and the method of converting the cinder iron introduced by Messrs. Hill and Co., has so materially deteriorated the qualities of mercantile cast-iron that considerable discretion must be exercised by the architect engineer, in the application of the ordinary formulæ given for its use.

The building arts have benefited by the improvements in metallurgy in other ways than in the cheapening of cast-iron. Thus, for instance, the facilities afforded by those improvements for the manufacture of rolled plate and angle iron, have, under the influence of the constantly increasing exigencies of the public, forced architects and engineers to adopt, about 1846, the plate-iron system of girders, with which the names of Stephenson, Fairbairn, Hodgkinson, and Clark, will always be connected, as inventors and appliers. Wrought iron is now also used largely in bridge construction, in the shape of chain and wire suspensions, or in the form of lattice girders, or even as girders avowedly designed to resist efforts of compression; and more lately still, the introduction of Bessemer's system of preparing steel seems likely to modify, to some extent, the methods of girder and chain structure at present received, for if the powers of resistance of the steel so made should prove to be tolerably uniform, its greater elasticity will, in many instances, lead to its substitution for the cheaper, but less elastic, and consequently bulkier, wrought iron. Again, the diminished cost, since the commencement of this century, of some of the other metals, has increased the number of materials at the command of the architect and engineer, for both constructive and ornamental purposes. The preparation and extraction of zinc, copper, and tin, for example, have all been diminished in cost of late years; and consequently the manufacture of their alloys has followed the same direction. The applications of platinum, aluminium, and iridium are as yet, too few, and too costly, for ordinary building purposes; but the alloys of aluminium seem likely, in fine machinery

works, to supplant the use of gun-metal entirely. The new methods of preparing lead for mercantile purposes, in the form of rolled sheet and drawn pipes, or even in the form of pipes made by hydraulic pressure, and the introduction of the various methods for galvanising iron, have equally increased the resources of the builder since the commencement of the present century. Even as late as 1840, we may add, much cast lead was employed: at the present day none but rolled lead is used.

It may not be out of place here to dwell for a short time upon the reciprocal influence which the arts of locomotion and of construction have exercised upon one another. The execution of the great network of canals led to the discovery of expeditious modes of forming earthen embankments, to the rapid execution of tunnels, and to the application of cast iron to building purposes. Simultaneously with the establishment of this canal system, the wonderful system of our turnpike and parish roads was being developed—at the same period, be it observed, that the first Imperial Government of France was carrying on the works of the Simplon, Mont Cenis, and Riviera routes. In the course of the execution of these English roads, Telford displayed the originality of his genius by the introduction of the suspension principle in bridge building, at Menai, Conway, &c., and thus solved the great difficulty of spanning wide openings at a small expense; whilst the execution of the Southwark bridge, by Mr. John Rennie, proved the extraordinary capabilities of cast-iron as applied to arches. But it was the railway system which gave the great impulse to the arts of construction, by the compulsory introduction of wrought-iron as the material to be employed in the execution of girder bridges. It may be that some devoted admirers of the architectural styles of peculiar epochs may regret the facilities afforded for carrying out trabeated construction, by the discovery of the laws of resistance of wrought-iron girders in the course of the experiments required before attempting the construction of the tubes for the Menai and Conway bridges. There are, however, I believe, few practical architects who do not feel, and who do not willingly acknowledge, the debt of gratitude they owe to the illustrious men who have so immeasurably extended the resources of their art.

The introduction of the new building materials has not been limited to the metals alone, for since the peace of 1815 especially, the world has been ransacked to supply our markets. Marbles are brought from the French Pyrenees, Belgium, Italy, Spain, Greece, and Russia; whilst oddly enough, we as perseveringly neglect the resources our own country affords—as in the cases of the marbles found near Plymouth, in Derbyshire, and in the Isle of Anglesea, and in Ireland. The Caen, Aubigny, and Maltese stones have been used here, sometimes on a large scale, and with tolerable success when proper precautions have been taken, but the more resisting tertiary limestones of the Paris basin, strange to say, have never been introduced. At home our stone merchants have been more active, for since 1800, the great market of London and the west of England has been supplied with numerous varieties of stone previously unknown to our masons. The oolitic series has furnished us the Barnac, Kettering, and Bath stones, to which new railway facilities will soon probably add the Upway and Tisbury varieties of the Portland stone. The Magnesian limestone series has supplied the Anston stone, the value of which (in our London atmosphere at least) seems to be more than equivocal. The sandstones from Yorkshire, the millstone grits of Bramley-fall, and the various stones from Cragleith, Arbroath, Dundee, &c., the slates of Bangor, the flag-stones of Caithness, Rockhill, Yorkshire, Arbroath, &c., have all likewise been recently added to our resources, and judiciously employed, they might immeasurably increase the facilities for the execution of polychromic decoration. The recent introduction of the White Suffolk-brick, and of the variously coloured marl and kiln burnt bricks, has naturally acted in the same manner as the introduction of the variously coloured stones above mentioned, or of the asphaltes, the use of which on a large scale, dates from 1837.

The same activity has been displayed in the timber trade, and the number of woods at our command has greatly augmented since the peace of 1815 especially. Fiscal arrangements have, however, somewhat interfered with the natural course of the timber trade; for until a very recent period there was a differential duty in favour of our Colonial produce, which tended to keep foreign woods from our market. There is now, however, no advantage in the use of Canadian or American baulks; and none but the superior descriptions of red and yellow pine deals are likely to be sold here. Nearly all the fir timber used in England comes from the North of Europe, and, as is universally known, it is of a superior quality to that of the timber formerly brought from America; though unquestionably the new woods, such as the hackmatac, cedar, green-heart, imported from that continent, should be exempted from the implicit condemnation contained in this observation. For the two first-named of these woods have great power of resistance to the effects of alternate dryness and moisture; the latter, the green-heart, is said to resist the attacks of the teredo-navalis, and of other boring worms. Perhaps these newly-introduced woods are more especially adapted to engineering purposes than to those more correctly named as architectural, but the Italian and Prussian oak, the African and Moulmein teak, the bird's-eye maple, the satin-wood, and the newly-imported Vancouver's Island timber, have placed at our disposal extraordinary facilities for the execution of beautiful architectural details in this class of materials. I would beg to dwell awhile upon the consideration of the last-mentioned wood; not only on account of the great advantages it offers in the execution of constructive details from the enormous length* and scantling it presents, which render it invaluable for roofing purposes, but also on account of the beauty and clearness of its grain. I have employed it myself for some elaborately panelled wainscoating, and I distinctly state that I never saw any fir timber fit to be compared with it. The workmen who may use this wood will, it may be added, find that it requires that the tools should be kept remarkably sharp, but no other extra precaution need be taken in working it.

It would not be just to dismiss, with a merely incidental notice, the wonderful improvements lately made in the ornamental ceramic and vitreous arts. The extensive use of stoneware in the manufacture of pipes for house sewers, waterclosets, &c.; of glazed earthenware for tiles, sinks, and numerous other domestic purposes; and of encaustic tiles, Palissy ware, China and Parian wares, have, for instance, enabled the architects to attain new and brilliant effects. Messrs. Minton, Copeland, Davenport, and their colleagues, have, indeed, nobly carried forward the art so brilliantly inaugurated in the last century by Wedgewood; but perhaps the most decided revolution effected of late years in the details of the arts of construction is the one which has taken place in the glass manufactures, in consequence of the abolition of the excise duties, about twenty years since. The glass formerly used in England was both small in dimension, and bad in quality; whereas at the present day the quality and dimensions of mercantile glass are such as to enable the architect to execute any description of ornamental work he may possibly require, so far, at least, as those materials are concerned. It is to be hoped that our Government may profit by the lesson thus taught them, and that they may relieve the manufacturers of paperhangings from the difficulties thrown in their way by the excise upon paper. Perhaps I may be allowed here to digress a little into the region of political economy, and to observe that it is not to be expected that an improvement in the manufacture of paperhangings would immediately follow upon the abolition of the paper duty. It requires some time before the conditions of a manufacture can adapt themselves to new fiscal arrangements; and, as in the case of the repeal of the excise on glass, it was some years before our manufacturers derived the

* Some sticks of this timber are not less than 127 feet long, by 36 inches square at one-third of the length.

full benefit of the measure; and, as in the case of the repeal of the excise on bricks, little change has yet been effected; so in the case of paperhangings it may be some years before our manufacturers may recover their ancient position in competition with the manufacturers of other countries.

The science of applied chemistry has, since 1800, rendered service to the arts of construction in other cases than those connected with the manufacture of artificial cements, or with the improvement in metallurgy and the ceramic arts. Thus, the introduction of the oxide of zinc or the sulphate of baryta, as substitutes for the oxide of lead, as the base of oil colours; the great improvements lately effected by the able chemists of France and Bavaria, under the guidance of such artists as Ingrès and Cornelius, in the painting on glass; the processes of Kuhlmann and Ransome, for the preservation of building stone by the application of soluble silicates; and the processes of Kyan, Margery, Bethell, and others for the preservation of timber, by the use of salts of mercury, or copper, or of creosote; and the discovery and application of the electrotype process by Spencer, may be cited amongst the more apparent benefits conferred of late years upon our pursuit by chemistry. I do not dwell upon the technical improvements in the moulding of horn furniture, in the applications of caoutchouc, gutta percha, leather, or of the textile fabrics; nor do I dwell upon the wonderful change which has been effected of late years in the mode of procuring and of distributing artificial light, because these various manufactures are of a character sufficiently distinct to require separate notice. But it must be evident that every one of these improvements in manufactures has acted markedly upon the style and character of many details of the decoration of house interiors especially; at the same time that it has enabled us to attain effects which it would, previously to the commencement of this century, have been absurd even to have attempted. The increased number of the mineral and vegetable oils, of varnishes and pigments lately placed at our service, have likewise exercised a distinct influence upon ornamental decoration.

The third branch of the subject before us—viz., the review of the improvements effected in the arts of construction by the use of new tools and machinery ought, properly speaking, to be divided into two sections, one of which would be devoted to the consideration of the tools used in the manufacture of other tools; and the second, to the consideration of the machinery actually employed in building operations. It would, however, occupy too much of our time were we to dwell upon the principles, or the details of wheel and screw cutting, of turning, punching, slotting, and boring engines, important though they be in the history of art; and I propose only to call your attention to the new machinery which comes immediately under the notice of the architect and building engineer. The number of these machines is daily increasing; for the continued rise in the rate of wages, the scarcity of labour produced by the extraordinary emigration of late years, and the consequent almost inevitable restlessness and indocility of the labouring class, have driven the employers of skilled labour to seek to substitute mechanical for manual labour wherever it has been possible so to do. As the architect formerly was expected to know something at least of the names and uses of the tools employed in the various building trades, so now he must understand the general action of the machinery, by means of which his designs are carried into effect, and which are employed in the works he is expected to value.

In carpentry, machinery is little used, unless for the purposes of driving piles, or of hoisting or transporting wood. Some years ago I had the honor to call your attention to the former class of engines; and at present I would simply add that at the beginning of the present century the old ringing engine was the only one in use. This was replaced gradually by the heavy monkey worked by the crab; and, subsequently to 1844, by the steam pile driver, by Nasmyth's hammer, and by Dr. Pott's system of pneumatic pressure. For the purposes of hoisting and transporting timber the first great improvements made since the commencement of this century, were those introduced by Mr. J. Rennie, in the mahogany sheds of the West India docks, which have, in fact, served as the types for all the more modern travelling cranes. Mr. Telford introduced some ingenious modifi-

cations of both the pit and double crane, in his various canal and dock works; and in some of the more important shipbuilding establishments the Derrick has been latterly applied for the purpose of hoisting long, cumbrous, timbers. In ordinary architectural practice, however, a "guy pole" and a crab are nearly all the hoisting machinery required for carpenters' work, just as they were "sixty years since."

Since 1830 the application of machinery to the various descriptions of joiners' work has taken place on a much more extensive scale. The circular saw, and the block machinery, established by Sir Mark Brunel at Portsmouth, was the first step in this direction; and it was followed by the general introduction of the frame or pit saw, and of the circular and the veneering saws, now so common. More latterly still, the ploughing, grooving, tennon cutting, planing, moulding, fillistering, and even carving machinery, have been introduced; whilst the system of artificial dessication has been rendered available for building purposes—with what success it would yet be hard to say. Machinery has likewise been applied to the sawing, working, and polishing of marbles, slates, and stones of a uniform quality; to the making of mortar, the tempering clays for brick and pipe making, the moulding of such bricks and pipes, the grinding of limes and cements, the rolling of metals into various forms, the hoisting of building materials (as exemplified in the new Houses of Parliament, and in the very remarkable structures around the new Basins at Marseilles), the execution of earthworks in formations of a tolerably uniform character, and to the execution of artesian borings of great depth. The motive power adopted for the above descriptions of machinery has varied in accordance with the necessities and the capabilities of the situations where they have been applied; and wind, water, and steam have been pressed into our service. In England the tendency is decidedly to use steam, on nearly all occasions, in preference to the apparently cheaper, but more uncertain, natural agents. Hydraulic power has latterly been employed with remarkable success in many cases; such, for instance, as the hoisting of the gigantic tubes of the Menai and Saltash bridges, in launching the Great Eastern, &c.; and the facility with which the ordinary unloading operations of the docks are carried on by means of hydraulic machinery would induce us to believe that it might be applied to building materials, when large quantities of work are to be performed in a small space, and in a brief period. In the construction of some railway viaducts lately erected, steam machinery has been used for hoisting the materials; but I am not aware that hydraulic machinery has been so applied.

In some of the branches of an architect's duties (which modern practice seems likely to withdraw from the members of that profession, in order to confide them to the newly-established class of Civil Engineers, but which formerly was considered to be, as I have called it, a "branch of the *architect's* duties"), viz., the construction of bridges, two minor mechanical improvements may be alluded to as having been introduced since 1840. The first of these is the application of boring machinery to the formation of the passages for the tying down chains of suspension bridges; to the preparation of the holes for receiving the tubes, subsequently filled in with concrete, intended to replace piles under the body of the structure; and to ascertaining the nature of the subsoil of the intended position of the bridge. The second of these improvements is the one connected with the lowering of the centres of an arch—an operation of the greatest importance in that branch of construction; for if the centres should be removed abruptly, or with a jar, the solidity of the vault they support may be dangerously affected. There have been several notices in the Annales des Ponts et Chaussées on this subject, to which I beg to refer my hearers; at present it may suffice to say that the system which has been most prominently brought forward is the one in which the centres are made to bear on bags filled with dry sand. The escape of the sand is regulated in such a manner as to be under instantaneous control, and the centres are thus eased without shock or jar of any description.

In ordinary building operations very little improvement has been, or could be, made upon the implements formerly used. The shapes of shovels, spades, tools, navvies' barrows, dobbin carts, earth waggons, timber and stone whims, spring carts, with straight or cranked axles, carpenters', smiths', or masons' tools, have all, no doubt, been greatly modified to meet the continual demands for rapidity of execution; but it would hardly enter into our province to notice them. Neither would it be worth our while to dwell upon the improvements in, or the applications of, the ordinary Bramah's press, or of the screw-jack; and we can only, in passing, allude to the ingenious devices adopted by our Transatlantic brethren for transporting, bodily, the buildings they wish to preserve, and to the cumbrous machinery employed by M. Lebas to raise the Obelisque de Luxor, at Paris, in 1837. Strictly speaking, also, attention ought to be called to the wonderful changes which have been superinduced in our modern domestic arrangements by the universal application of the water-closet system, by the improvements in the details of water supply, by the improved methods of heating, lighting, and ventilation, and even by the use of speaking-tubes, bells, and, in some cases, of the electric telegraph. But the mere enumeration of these adaptations of physical science to the ordinary wants of life is sufficient to show the range of the investigation before us, and the utter impossibility of including the whole of it in one lecture. It may suffice, therefore, at present to say that the tendency of all that is going on around us is to increase the number of the material elements of comfort at our disposal, if only by reason of the facilities they afford for improving the sanitary state of our homes. At the same time, however, all the improvements in the arts of building tend equally to increase the powers of the architect of the present day to produce effects in the æsthetical branch of his pursuit, which were physically beyond the reach of his predecessors, devoid as they were of the wonderful facilities offered by the new materials, the new processes, and the new machinery which have been introduced subsequently to "sixty years since." The power of obtaining and handling stones, and beams of gigantic dimensions; of spanning great openings by the use of small materials connected by new mechanical processes, or by new cements, and of erecting important structures in positions wherein formerly it would have been impossible to attempt any permanent work, have given rise to a spirit of boldness and hardiness of mechanical daring, which must eventually re-act upon the artistic expression of our age. An attempt was made in the erection of the Crystal Palace to eliminate a style of architecture which should be characteristic of the state of the mechanical arts of the day, and in the Menai Tubular Bridge a structure has been raised, whose simplicity of outline and grandeur of effect approach as near to the character of sublimity as can be conceived. Neither of these structures were, however, faultless as works of art, the Crystal Palaces, both old and new, being, in my opinion, as ugly as they could well have been, but the signal has been given, the path in which we ought to march has been indicated; and if we boldly look forward, instead of backwards, if we strive to create an architecture of the future instead of contenting ourselves with an architecture based upon a reproduction of the past, the progress made in the mechanical arts of late years will not remain so sterile as it has been for architecture. One of the first lessons to be learnt by the artists who would seek to make to themselves an abiding reputation by their application of the means and appliances lately placed at their disposal, seems to me to be that the laws affecting the the resistances of the materials themselves, require that they should be treated in many cases so very differently from the older materials, that it is absurd to attempt to adhere to archæological correctness of detail, or in other words to endeavour strictly to apply the principles of ornamentation of styles which prevailed in other times. I allude especially to the miserable attempts to be seen in our own country, and abroad, to execute Gothic or Grecian designs, such as bridges, colonnades, &c., in cast-iron; because the feeling of logical impropriety must be excited when we look at the Pointed

arches and the meagre chamfering of what it is the custom to call a Gothic cast-iron bridge; and the incongruity of the intercolumniations of the so-styled Grecian colonnades must always offend an educated eye. In fact, just as the use of the Grecian marbles, and of the Roman bricks led those nations respectively to modify the forms of art they had received from other nations, so ought the use of cast and wrought-iron, of glass and cement in our day, to lead us by degrees to eliminate a style characteristic of our generation.

It seems, indeed, to me that the moral to be derived from our cursory review of the improvements made since 1800, in the mechanical arts of construction, is precisely that it behoves us all, Engineers and Architects, to seek to discover the true spirit in which those improvements should be applied. The materials, machinery, and principles of practical execution lately introduced, regarded as elements of art, ought, I think, to be used with reference to the physical and mathematical laws affecting them, rather than with reference to their powers of adaptation to any particular style of architecture. There should be no attempt to produce, by the aid of cast and wrought-iron for instance, sham Gothic tracery, with all the joints of the stone ribs elaborately reproduced by marks on the face, such as I have seen in some instances abroad. Cements should not be used with scorings, in order to look like stone; nor should cast-iron columns be painted to look like marble. Each material should be used in the position for which it is best adapted; and should "tell its own tale" honestly, and without disguise, in a way to satisfy the judgment of even those who have not the time to seek the hidden explanation of the objects directly before them. Possibly the earnest attempt to bring about this result, may cause the quarrels of *Classicists*, and *Mediævalists* to fall into comparative insignificance; but candidly would that be a misfortune? Why need we be always "au char de la raison attelés par derrière?" Must we always be compelled to seek in the practice of the past a justification for the designs we may make, and the system of construction we may adopt, when the whole tendency of our civilisation, and the spirit of the age, would lead us to strike out a path of our own, distinct in its character from those of former times, though of course based upon the æsthetical principles which the experience of ages has confirmed? In the charming opera "La Dame Blanche," one of the characters repeats as a reason for doing some old-fashioned act—"Car c'est ainsi que cela se pratiquoit en Ecosse il y a soixante ans." We, it is true, are little disposed now to seek models from amongst those who practised "sixty years since;" and they themselves could boast of little originality of invention. The architects, engineers, and mechanicians of, and subsequent to, that period have, however, endowed us with means and appliances which, rightly used, would enable us to leave "our foot-prints on the sands of time," if only we dare to think and reason for ourselves. May we not, therefore, consider that the course we ought to follow should be to strive after the attainment of a style which should be characterised by its mass, and simplicity of outline; its boldness and its truth; its strength and sublimity in structures which may be susceptible of that quality; and that we should, in short, adopt Montaigne's sentiment, and seek "nous tenir au massif et vraisemblable?" The effect of the various improvements in the mechanical arts seems to tend, as it were, to efface detail, the excess of which is the defect of most scholastic art of the present day; and at any rate they would give scope to any magnitude of conception the architect, or engineer, might be inclined to indulge. From what has been done at the Britannia-bridge, the joint railway station at Birmingham, the Reading-room of the British Museum, and the Crumlin Viaduct, we may learn that more remains to do, before we can flatter ourselves that we have turned to its full artistic use "*the progress made in the mechanical arts of construction since* 1800." We must, in fact, learn to be truly ourselves, before we can fairly consider that we have reaped all the benefit of the changes made of late years upon the mechanical arts which prevailed "'TWAS SIXTY YEARS SINCE."

ON THE SUPERINTENDENTS OF ENGLISH BUILDINGS IN THE MIDDLE AGES; WITH ESPECIAL REFERENCE TO WILLIAM OF WYKEHAM.

By Wyatt Papworth, Architect. Read at the Royal Institute of British Architects, January 23rd, 1860.

Since the time of Walpole and Dallaway, little has been done to compile any notices of the early practitioners of our art, or to ascertain who were really the persons entitled to the credit of designing the works erected during the Middle Ages. That credit, especially with respect to ecclesiastical buildings, is generally ascribed to certain men of high rank in the Church,—while the claims of a body of working men, called Freemasons, to have devised and directed the operations necessary to the development of their employer's wishes, have also been put forward. Searching into the numerous printed as well as MS. authorities, whence these respective deductions have been drawn, I have been induced to form a collection of notes which enable me to have the satisfaction of now bringing before you the first classified account of the official situations of persons upon buildings erected during the Middle Ages, with some general idea of their duties. Wherever practicable, I have chosen the words of the original document, or the apparently best translation; a course which has led me to discard some of the hitherto received quotations.

My observations will include the terms Architect; Ingeniator; Supervisor; Surveyor; Overseer; the employment of William of Wykeham; his Master Mason; the Master of the Works; the Keeper of the Works; the Keeper of the Fabric; the Director; the Clerk of the Works; and the Devizor; reserving, for some future occasion, all notice of the Master Mason and of the Freemasons.

Of the term Architect, I find no use within the period to which I propose to limit my remarks. Walpole, in "Anecdotes, &c." 1762, recites a writ, dated 1199, (10th Richard I.) wherein one Elyas, Ingeniator, was allowed ten marcs by the Sheriffs of London and Middlesex for the repairs of the King's Houses at Westminster. This word has been translated "Engineer or Architect;" and Walpole stating that Elyas was certainly an architect, mentions this writ, with another, a few years later, as being the earliest evidences of art in our records. This memorandum is valuable as far as it goes; but it is the only one to which I shall refer in respect of that title, as we may be more inclined to translate the original term in the writ by the single word Engineer.

A term used several years after the Conquest was Supervisor; and this word has generally been translated Surveyor, or perhaps Overseer. The earliest mention of a Surveyor or Supervisor of the Works, (even the term Architect has been applied in the translations), is in the case of the erection of a bridge at Hereford, between the years 1100 and 1135, when Alduin de Malverne is said to have held such an office. Passing some uncertain uses of the term, we are told that in 1349, Edward III. appointed John Peyntour to the office of Surveyor of the Works at Windsor Castle. I am inclined, however, to believe that if the original document were inspected, the word so translated would prove to be Supervisor. I lay some stress on this point, because my endeavour is to show that Supervisor, although changed to Surveyor in later times, never meant the Surveyor of the present day. In the following year, Richard de Rotheley, (or Richard de Rochelle), appears to have held the same office; he is also recorded to have held it once before. Subsequently, but in the same year, William de Hurle and William de Herland also received the appointment. The following year 1351, Robert de Bernham held the office: "and," as is recorded, "to the end this great undertaking might be honestly and substantially performed, the King (Edward III.) assigned John Brocas, Oliver de Burdeux, and Thomas

de Foxle, jointly and severally, with all care and diligence (at least once a month) to survey the workmen and their works, and to encourage such as did their duty competently well, but to compel others that were idle and slothful." Bernham still held office in 1353; and it was on the 30th October, 1356, that William of Wykeham was appointed to the post of "Supervisor of the King's Works at the Castle and in the Park of Windsor," having the like powers with those Surveyors first named; the payment was also the same as that enjoyed by his predecessors, namely, one shilling per day while resident at the works; two shillings a day while travelling; and three shillings per week for his clerk. The following year his salary was enlarged to two shillings per day, 'until he should obtain ecclesiastical preferment.' I have been thus particular in the remuneration, because the Clerk of the Works at the Castle, a few years earlier, was paid, according to the authority I follow, 'two-pence' per day, but this is clearly a mistake for two shillings, the usual payment for the 'clericus operationum regis.' This difference would lead us to consider that the Supervisor ranked lower than the Clerk of the Works. Moreover, it is recorded, that in 1358, William de Mulsho was appointed Supervisor at the Castle; where then was Wykeham? And again, on the 10th July, 1359, a writ testifies that Wykeham was "capitalem custodem et supervisorem castrorum regis" of Windsor, Ledes, Dovor, Hadley, and other places, which included something more than mere works in progress. In 1361, William de Mulsho was appointed Clerk of the Works; and in the following year, when Wykeham resigned his appointment, he was succeeded by Mulsho, who appears to have held the appointments of both Clerk and Supervisor until 1364, when Nicholas Bernard took the post of 'Surveyor,' (as he is called in the translation), for life; and in 1366, Adam de Hertyngdon became Clerk of the Works in place of Mulsho. As these transactions may be regarded as genuine evidence, it is clear that the Supervisor, if promotion and remuneration be taken into the account, was of inferior rank. I have also found a notice of this office as late as the time of James I., when Sir John Trevor is called "Surveyor and Receiver of our Honor and Castle of Windsor." For the present, however, I must quit Windsor, and see what information other records afford towards clearing up the point. The next in my list, after that of 1366, is dated 1370; in this, Thomas Staple called the King's Serjeant-at-Arms, is granted a shilling a day for good service rendered; in the same year he is termed by the translator Surveyor, and also Overseer, of the works of the Lord the King at Queenborough Castle. He had upwards of £153 (about £1850 of our money) paid to him for the works then being executed or completed. Was he an architect? In the same year also, 1370, the Prior of Rochester Cathedral was paid a somewhat larger sum for works at the Castle in that city, while acting as 'Surveyor' or as 'Overseer.' John Boyfield had been Supervisor of the works under the two Abbots of Gloucester preceding himself; he is one of the proofs of the supposed system of electing monks, acquainted with building and other operations, to the higher and responsible positions of Prior and Abbot.

Dated 1417 and 1422, are two orders, written in a mixture of old French and English, giving about the earliest uses of the word Surveyor; thus, in the first of them is mentioned, "Notre amé Esquier Robert Rodyngton, surveour de la construction de noz Toures a Portesmouth;' in the other, 'une surveiore de les oveignez de devf. chastell et villes deing Northgales.' But how shall we regard another order, dated 1417, in fairer English, requiring 'sum gud, true, suffesaiunt mon, to be surviour of vitel and werkes in North Wales?' This curious union of appointments appears again in 1338, when Edward III. made his Clerk of the Works at Perth, in Scotland, "receiver of the pennies and of victuals;" and in 1384, Richard II. made his Chamberlain of Berwick the Clerk of the Works there, and also "keeper of the victuals and artillery;" in the same year he was also constituted the "Chancellor and Chamberlain." During the erection of King's College Chapel, at Cambridge, we find recorded, that in 1441, there was an Overseer and Manager; in 1451, a Clerk of the Works; 1479, an

Overseer; 1484, an Overseer; 1513 to 1527, a Surveyor, in the person of Thomas Larke, termed 'Mr.' in the first year, but 'Clerke, Archdeacon of Norwyche,' in the latter year. All Souls' College, at Oxford, was erected under the supervision or inspection first of John Druell, 1437-42, and subsequently of Roger Keys, 1442-44. They kept the accounts which were in existence at the end of the last century. Roger Keys had previously (in the words of the grant) rendered such 'acceptable and laudable services, and in many and divers ways renders, and will in future render to us, as well in our operations connected with the building of our Royal College of St. Mary of Eton, as in other respects'—that the monarch, Henry VI., ennobled him by a grant of a coat of arms. He had acted as Master of the Works, an office to which I will refer hereafter; Robert Kente, William Lynde, and William Waryn were to be the Overseers, William Lynde being also the Clerk of the Works; and John Hampton, Esquire, an attendant upon the King's person, being Surveyor.

In 1461, to John Kendale was granted the office of 'Supervisor of all the King's works' throughout the realm. In 1474, Richard Beauchamp, Bishop of Salisbury, was 'Master and Supervisor of the Works at St. George's Chapel, Windsor, then being rebuilt; he was succeeded by Sir Reginald Bray with the same titles. The Tower of Magdalen College, Oxford, was added in 1491-95, during which time Magister Gosmore had the supervision, which included keeping the accounts of it. To John Alcock, successively bishop of Rochester, Worcester, and Ely, and Lord Chancellor, many works in architecture have been attributed, probably because he held the office of Comptroller of the Royal works and buildings under Henry VII.; which monarch, in making John Islip, Abbot of Westminster, receiver of the money for his chapel at the Abbey there, gave him the supervisorship, and thus, chiefly, has Islip also had the title of architect attached to him.

So late as 1514, William Mavern, Supervisor of the Works at the Abbey of Gloucester, was elevated to the Abbacy. In 1520, the King granted to Thomas Vachell the office of Supervisor of all and singular the honours, castles, &c., &c., which had belonged to the monastery of Reading and to the late priory of Leominster, for his life, and to receive out of the issues and profits of the same, twenty marcs annually, (£13. 6s. 8d.) He is again called 'Supervisor or Inspector.' From this period the term Surveyor becomes very common, and it shortly appears to be used in the modern sense of the word. Thus, James Nedam, carpenter, was in 1531 appointed Carpenter to the King, and in 1539 or 1541, he is named Surveyor-General of the King's Works, and had the same salary as his successor, Lawrence Bradshaw, also a carpenter, viz., two shillings per day, the payment, as I have before noticed, of the King's Clerk of the Works. There was a Surveyor at the Tower of London, in 1542, at the same salary, which was increased forty years after by an augmentation of an allowance of £70 for diet, and £25. 13s. 4d. for riding charges and boat hire. As another use of the word Surveyor, we find in a late period (about 1510) that the endowment of St. Paul's School, London, was given to the Mercers' Company, to whom was entrusted its care, charge, rule, and governance; and they were to elect eleven persons annually, free of their Company, as 'Surveyors of the Scole.' These persons were to receive the rents of the endowments, and to transact all affairs relating to them and to the School—to pay the different salaries quarterly; and when the annual accounts were audited, an assembly should be appointed, and 'a litell dinner ordeyned by the Surveyors not exceeding the price of fower nobles.' These Surveyors were to have eleven shillings each for their labour for one year, and the same sum if they rode to visit the estates. A similar sense of the word is to be found in a legal document of 1680, stating that Sir C. Wren, with the Parson of the Parish and another person, had been appointed 'Supervisors' of the building to be erected, and which had been designed by that architect. During the reigns of Elizabeth and of James I., the head of the Royal establishment of Works loses the title of 'Clerk of the Works' (to be mentioned presently) and becomes 'Surveyor

and Paymaster;' and in 1628, 'Mr. Jones' is Surveyor alone. From that period we are well acquainted with the duties of that officer, as now understood. The duty of the Surveyor-General at the Tower of London, in 1756, was chiefly to inspect the stores and provisions of war; to see they were preserved with care; to allow bills of debt; to keep a check upon all labourers' and artificers' work; as well as to see that all provisions were good and serviceable, and that they were marked with the King's mark.

It is only occasionally that we find any mention of the duties of the Supervisor. In the case however of Wykeham, the first patent, as recorded by Ashmole, states that he was empowered to impress all sorts of artificers, and to provide stone, timber, and all other materials and carriages. The second patent was an extension of his powers, as besides the appointment and disposition of all workmen, providing necessaries for reparations, he was to provide carpenters, masons, and other artificers, stone, timber, &c.; also to hold leet and other courts, pleas of trespass and misdemeanours; and to enquire of the King's liberties, rights, and all things appertaining thereto. Would not our word 'Steward' be a more appropriate interpretation of the word 'Supervisor' when used in the old records? In support of this view I would mention that Shakspeare in his play of Henry VIII. act 1, sc. 2, gives the term Surveyor to the Duke of Buckingham's Steward of the Household, (as I read the passage),—thus recalling the old term Supervisor. And Shakspeare (to judge from Henry IV., 2nd pt., act 1, sc. 3) may perhaps have understood the difference between such an officer and an Architect or Surveyor of Buildings; but this last use of the term might be interpreted both ways.

There is one other employment of the term Supervisor, and, as it is found in the words of Wykeham himself, the meaning is of great importance. In his will, he directs that the works of the Cathedral at Winchester are to be continued under the care of William Winford; of Simon Membury,* now Supervisor of the said work and also Paymaster, who is to be Paymaster and Supervisor during the continuance of the above-named work; and of John Wayte, the Comptroller on the part of the Convent. It will be observed, that he does not state the exact position which Winford held or was to hold; but as I shall have again to refer to him, I will leave further remarks for that occasion.

Now, so far as we have pursued the enquiry, shall we not be rather inclined to deny that William of Wykeham is entitled to the name of 'Architect,' in our sense of the word? Tradition, warping the meaning of early historians, has assigned to him wonderful powers of design in architecture. Is tradition always to be relied upon? Allan Cunningham, in his life of Wykeham, states that "under whose auspices he attained his knowledge in architecture, has not been told, nor have we any notice of any of his designs before his twenty-third year," We know how to estimate the real value of tradition in the case of Van Eyck, the reputed discoverer in 1410 of oil painting, (he was born just after Wykeham was made Bishop, and he died about forty years after him); and also in the case of Sir Richard Whityngton, four times Lord Mayor of London, who also flourished during the last years of Wykeham's life. Not only is the origin of the story of the cat placed about a century after its supposed master's death, but it has been discovered that the pennyless Richard was the son of a rich man of title! Within the last few years an enlightened French author has acquitted the English of the traditionary crime of roasting the Maid of Orleans, and shown that she lived a married life for years after the date assigned to the event: while recently, the sorrowful catastrophe of the interesting Amy Robsart has been reduced and vulgarised into a case of felo de se! The term, "rising Wykehams," must be, I think, retained for the benefit of young Ecclesiastics, rather than

* "Nunc dicti operis supervisor nec non et solutor, sit etiam solutor et supervisor in futuram, durante opere supradicto."

of aspirants in our profession, unless indeed the time shall come when an architect may again be considered eligible for a Bishopric, as some slight return for the usurpation of the title of architect by so many bishops.

It is said that it was partly Wykeham's knowledge of architecture which induced Edward III. to employ him. But examine the authorities, and there is nothing but tradition to support the argument. It was by the advice and persuasion of Wykeham (in 1359 says at least one author) that the King was induced to pull down great part of the Castle of Windsor, and to rebuild it in a magnificent manner. But works there had been commenced by that King some ten years previously. Moreover, it is said, that it was at the suggestion of the Kings of France and of Scotland, who were prisoners together at Windsor, that Edward III. was induced to extend the Castle, and he did so at the expense of his captive advisers. Another support of my argument is this: Wykeham was made Supervisor of the Works in 1356. Mulsho took his place (apparently *pro tem.*) in 1358, and Wykeham was appointed Constable in 1359; the alterations proceeded slowly until 1363, 1364, 5, and 6, when the amounts are highest. Now Wykeham resigned his appointment to Mulsho in 1362, the year before the heavy payments began, and at the time when Mulsho was acting as Clerk of the Works. The traditional account of the words 'Hoc fecit Wykeham,' attached to the walls of Winchester Tower, is put aside by some of his biographers; and Lowth commenting on his early life observes that all the particulars relating to his name, birth, parentage, [education, and early employment,] rest either upon tradition or upon accounts penned many years after his death, that is, at least, above fourscore years after the times of which they treat: we have nothing concerning him authenticated by contemporary evidence before the year 1352, when Bishop Edyngdon constituted him his attorney to take possession of certain lands; at that time he was twenty-eight years of age.

It may be in the recollection of many that even the chevron in the coat of arms adopted by Wykeham, was said to be commemorative of his architectural attainments, because the learned herald Upton has written that it was one of those bearings which were carried 'per carpentarios et domorum factores,' by carpenters and builders of houses. But another herald, equally learned, states that the chevron was usually taken by the head of a new house or family when arms were granted to him, (the chevron or rafter being at the top of the house,) and it was enlarged by one or two more chevrons, as the wealth of himself or of his heirs encreased. The number of coats having chevrons amongst the Ecclesiastics, presents a good elucidation of the fact, as well as the number appertaining to those, to whom it has never been attempted to affix the title of architect or of carpenter.

In 1360, Wykeham had been appointed Dean of St. Martin's-le-Grand, and continued so until some time in 1363, having been busy 'rebuilding the cloister of the Chapter House and the body of the Church' in a very handsome manner and at a very great expense. He also held from 1361 to 1368 the co-wardenship of the forests on this side of Trent. Although so early as 1349, the King had conferred the first benefice upon him, it appears that he could not take possession of the Living, not being in Orders; it was only in December, 1361, twelve years later, that he was admitted to the degree of an acolyte; it is, therefore, most probable, that the King gave him the office of Clerk of the Works at Henle and Yeshampstead, with that of Supervisor in the same and in the following years, in order to afford him an income; indeed, this appears to be the true reason, from the patent of November, 1357, which doubled his salary until he could obtain Ecclesiastical preferment. In all the patents of appointments granted to Wykeham he is styled 'Clericus,' hence many have presumed him then entitled to be considered a churchman; it was "a title addressed to academical students," says Walcott, one of his biographers; but this may be doubted, though it probably was applied to all educated persons, especially those who could write. Thus it is affirmed, that the word "Clericus, often affixed to the names

of witnesses in an early period, does not always signify a clergyman, for this was expressed by persona, or if he was not beneficed, by capellanus; clericus seems commonly the person who wrote the instrument." This is, however, rather a digression, but yet it was necessary to explain away the seeming force of the epithet.

From the often quoted year, 1361, Wykeham, however, was making rapid progress in the church, until he obtained within the short period of six years, the bishopric of Winchester on the 17th September, 1367. During these years Queenborough Castle was erected, (1361, and finished in seven years, as generally stated) and is traditionally ascribed to Wykeham as its designer; yet one author has named Henry Yevele as the Supervisor of it. As such works would necessarily in those days entail the personal supervision of the designer, I cannot but be strongly of opinion that Wykeham's thoughts and presence were of more importance (to himself) elsewhere, and therefore that he did not act as Architect at its erection. He is also said to have been the originator of the Perpendicular style of Mediæval architecture, but as this assertion rests on the assumption of his having been an Architect, the further consideration of this claim for Wykeham may be deferred to the time at which the origin of styles shall be settled. The College at Oxford, founded by Wykeham, was not commenced until the end of the year 1379, twelve years after Wykeham had been installed in the episcopal dignity; the College at Winchester was commenced eight years later still; and it was not until another seven years, namely, 1394, that he decided to commence the reconstructions at Winchester Cathedral; in 1403 he made his will, a few months before his death in 1404. Now, supposing that he was the Architect of these buildings, we must also suppose that he was a Freemason, and acquainted with that important secret of design which we are all so anxious to re-discover; otherwise much that has been maintained as to the wonderful attainments of that band of skilful designers and workers falls to the ground. But I cannot suppose that he was one of the craft. He has too, the quasi honour of being twice mentioned in that very questionable list of Grand Masters of the Fraternity, under the dates of 1357 and of 1377; the first, the year after he had been appointed Supervisor; the second, before he had commenced his Colleges. But we yet require some evidence that any bishops were ever made acquainted with the secret; the contrary even might be judged to be the case by those who have considered all that has been written respecting the celebrated statute of Henry VI., which was passed for putting down the assemblies of Masons. We must not forget either, the fate of a German bishop, who was killed by a master mason, because his son had been beguiled or had unwittingly betrayed the secret to the bishop. I am of opinion that Wykeham was not one of those initiated in the masonic mysteries, and consequently, in this light, could not have been the designer of his Colleges. Who then was the talented person? This portion of the subject led me into a more extended field of research than I had at all anticipated; and the result is satisfactory only to a certain extent. It leads me, however, to believe, that the Master Masons were generally the architects during the Mediæval Period in England. The steps of the enquiry will be best understood if explained upwards in this account. Wykeham, in his most carefully drawn will, declares that "the disposition and ordination," whatever those words may truly mean, "of the works at the Cathedral, be made by Master William Winford, (I have mentioned his name before,) and others sufficient, discreet, and approved persons in the art, as may be deputed by my executors." But this is the first time Winford is mentioned by him, it may be said. Fortunately, he is almost the only exception I have found to a recurrence of a name; and furthermore, his portrait exists. In the stained glass of the College at Winchester,* may be seen the representations of three

* See Journal of the Archæological Institute, Winchester Proceedings, 8vo. 1846.

personages; first, the Carpenter, whose name unfortunately is lost to fame, unless it can be recovered from the books of accounts; the second, our already known Willielmus Wynfor, lathomus, (or mason, a term to be explained on another occasion; and the third, Dñs Simon Membury, who has not any office appended, but whom I need scarcely remind you, is also named in Wykeham's will as the Supervisor and Paymaster of the Cathedral works. I conceive that in William Wynfor we thus obtain the architect of the College at Winchester, as well as of the works at Winchester Cathedral.* Now for that at Oxford. This however is not so easy of proof; I must beg leave for a little conjecture. The College was commenced, as before stated, in 1379. In a Roll of Expenses of the 44th year of King Edward III., under the date of 22nd April, 1370, it is recorded, that William de Wynneford, plasterer, (as the original word is translated, which, no doubt, is cementarius, or mason as it should be rendered,) was sent to various parts to retain divers plasterers [i.e. masons] to be sent over in the retinue of the Lord the King beyond sea, by command of the Chancellor. It is not a little in my favour that the Chancellor of this period was William of Wykeham himself. This Winford then, was a mason of some position; an equal with Yevele, who was employed for the same purpose, and we know he was a mason by his works at Westminster Hall. We may suppose him to have been about 30 years of age or more when entrusted with this command, so that at the end of 33 years, when mentioned in Wykeham's will, he would be at least 63 years of age, not too old to carry out the wishes of his patron. I should even venture to presume that both he and Yevele had been in the employ of the monarch at Windsor Castle; but as the records of the period, and especially the accounts of the Castle are scarce, no other mention occurs of his name; this early date of his employment, however, permits me to conjecture that Wykeham, appreciating his excellence, might have employed him at New College, Oxford. Some further research into the fabric accounts of the buildings may elucidate this point, as no doubt the name of the Master Mason will be found recorded, as usual, in those documents. Lastly, as respects this part of my subject, a friend has reminded me of the observation made by Wicliffe in one of his sermons, probably written between the years 1366 and that of his death in 1384, entitled, 'Why poor Priests have no Benefices.' It is only by inference, however, that the expression† used was applied to Wykeham, and considering all that I have brought forward, I am not disposed to believe that the cap fits his head.

The 'Magister Operum' or Master of the Works was an important one in monastic establishments. At Croyland, he was the first of the six greater officers. It was the Sacristan, or sometimes the Treasurer who held this post, and it was his duty to receive all the legacies and donations that were made for the support aud ornament of the buildings and utensils: to his superintendence was submitted the construction, reparation, beautifying, and enlarging of the churches and various buildings of the monastery, particularly those of the Abbot below the court, except some houses near the garden. John of Wheathamsted, Abbot of St. Albans, "who in architecture was the Wykeham of his time," is specially recorded to have instituted in his Abbey, a new officer called the Master of the Works. The Sacrist was also sometimes the secretary, auditor, and chancellor of the convent, therefore necessarily a very important personage. With this extensive employment it is remarkable how few names of Sacristans have come down to us. William Stowe, of the Abbey of Evesham, erected about 1319 the new steeple or belfry. Paulinus, of Rochester Cathedral, built between 1125 and 1137 the church at Frendsbury,

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* Lowth, in his Life of Wykeham, edit. 1777, p. 195, states, he employed William Wynford as Architect; Simon Membury was appointed Surveyor; and John Wayte, Controller, &c.

† I have traced this application of the observation to Warton, who appears to have first used it in his History of English Poetry, first edit. 1774-81.

in the same county. In 1237 died Elias de Lideford, the sacrist of the Abbey of Gloucester, who rebuilt the tower and constructed the stalls of the monks. This officer, in St. Oswald's priory at Nostel, in Yorkshire, about 1380, painted the refectory with his own hands, made new stalls in the choir, a new incense pot, a large processional cross, and some gold and silver images of saints in tabernacles for the altar. But of all Sacristans, we surely shall not forget Alan de Walsingham of Ely Monastery, one whose history is too well known for it to be necessary to be repeated here.

At Salisbury there appears to have been a 'regular Master of the Works,' although the nature of his duties does not seem to have been noticed by the historians of the Cathedral of that city. In the agreement made with John the plumber, in 1367, at York, it was arranged that he, the plumber, was to work with his own hand wherever he should be required by the Master of the Fabric or by another on his behalf; and if at any intermediate time of the year the fabric should not require his labour or repairs, having first asked and obtained leave of the Chapter or of the Master of the Work, he might lawfully work elsewhere; he was to return when required by the Master of the Work. At the same period there appears to have been a Keeper of the Fabric, who was to settle the amount of the day's work for the plumber and his servants, and who was to pay the salary at the stipulated periods. The Master of the Work, and the Keepers of the Works, and the Master Mason are also all mentioned together in a document of the same period, so there is no chance of confusing them one with another. Henry VI.. in his will, orders a payment of £50 per annum as salary to be paid to each of the Masters of the Works at his College of Eton, and of King's College at Cambridge; with £13. 6s. 8d. to the Clerk of the Works at each building. At the erection of St. George's Chapel, Windsor, Edward IV. appointed Richard Beauchamp, Bishop of Salisbury, to the office of Master and Supervisor of the Works, as I have already mentioned. This was in 1474, and in the will of this monarch, dated in the following year, he says, " We wol that the Church of the said College begonne by us of newe to be buylded bee thorughly finisshed in all things as we have appointed it by the oversight and assent of the said Bisshop of Sarum during his liff, and after his deceasse by the oversight of the Dean of the said Collage for the tyme beeing, soo alway that our Executours and Supervisour of this our last wille and testament bee prive to all charges and expenses that shal bee expended about it." We can hardly imagine from this description that either this Master or this Supervisor had much to do with the designing of such works; yet, not only has the commencement of this magnificent building been always attributed to the genius of the Bishop of Salisbury, but the completion of it has been equally attributed to Sir Reginald Bray, (who succeeded him, and appears to have finished the Chapel at his own cost), but whom I do not any more consider to have been a designer of architectural works than William of Wykeham. It appears that Thomas Canceler was, in the early part, the Clerk of the Works; but the name of his predecessor is lost. This Sir Reginald Bray has also had, times out of mind, the credit of designing Henry VIIth's Chapel at Westminster, but he died some few months after the first stone was laid 24th January, 1502; and the King refers in his will, dated 1509, to the prior of Saint Bartholomew's, in Smithfield, as the then Master of the Works of the Chapel, who had a picture delivered to him by the King, of the manner in which the Chapel was to be desked. This prior was William Bolton, who was himself a great constructor of edifices.

I have no other notice of this named officer for nearly two hundred years, until so late as 1701, when Robert Streeter, painter, was Master of the Work to be done in the Castle of Windsor, with the privilege of doing and performing the painter's work; from which it would appear that the meaning of the term had been altered equally with that of Supervisor. This officer would seem to have held a very similar position to that of the Supervisor, if not almost one and the same, and his duty evidently was to keep the accounts as paymaster; occasionally giving directions as to carrying out the works. I

find that in 1671, in Scotland, Sir William Bruce is mentioned as 'His Majesty's Surveyor,' and also as 'Master of the King's Works,' being then engaged on the buildings at Holyrood House, near Edinburgh, executed 1670-9.

The Keeper of the Fabric, and the Keeper of the Works, are two titles which have been already mentioned in conjunction with the Master of the Works. The earliest notice I have found is appended to the names of Henry de Cerne, the Treasurer, and others, at the Castle of Winchester, from 1222 to 1236, who are called Custodes Operationum. About the same period Odo, goldsmith, of Westminster, held the same position at the Palace of Westminster, and numerous writs, as well to himself as to his son and successor Edward, show that they bought things for the use of the King, and had works carried out 'which we had enjoined him to have constructed.' This Edward, more especially, was appointed one of the Treasurers of the new exchequer constituted for carrying out the rebuilding of Westminster Abbey. The Keeper of the Fabric of the Church at Westminster had upwards of 3000 marks paid to him in 1257, the period of its rebuilding. The Keeper of the Works at the Tower had £20 paid to him to provide necessaries for the works, Master Thomas, of Saint Sepulchre, being Overseer of the Works aforesaid, and also called the Engineer of the King's war slings in the Tower. Our next Keeper may not have been worthy of his office, if the following report of him be correct: —William de Wylughes, Keeper of the old fabric of the cathedral church of St. Paul in London, received £40 from the King for an iron tomb lately placed over the tomb of the Venerable Father Henry, late Bishop of London, purchased for the King's use for the tomb of Philippa, late Queen of England, within the Abbey of Westminster. The custos at the Palace of Westminster in 1332 was required to deliver up some lead which he had in his care. In 1350, the magister fabricæ of Lincoln Cathedral, was also the Treasurer of Lincoln. But more especially from Browne's History of York, published 1838-47, we obtain much valuable information. From the year 1311 until 1535, upwards of 200 years, there is a constant succession of Keepers of the Fabric; they all were receivers of the contributions for the works, and paymasters of the expenses; the rolls of accounts are kept in their names; one is called Master of the Fabric. But there is a curious incident connected with the three last persons who held the office of Keeper, which most probably would not have attracted the attention of any one not pursuing this course of enquiry. These three were, Magister Christopher Seell, succentor of the Vicars Choral, and Custos from 1515 to at least 1518, after which no Fabric Rolls are found until 1526, when Magister Thomas Marsar was Custos until 1535. In 1525, however, Magister John Coltman, Sub-treasurer of the Church, was Custos, as known from the following circumstance:—that, the adjoining Church of St. Michael le Belfrey, belonging to the Dean and Chapter, was rebuilt in the time of Thomas Marsar, the second above mentioned, and there were, and there are perhaps still, existing in that Church, three stained glass windows to the memory of these three Keepers, whom, in the three inscriptions, are each recorded to have been 'Clerk of St. Peter's Works,' (not Keepers of the Fabric), and these inscriptions are in black letter English, therefore there can be no error except in the acceptation of the term in our modern usage of it. Neither need we forget that the person at present often in charge of carrying out works at our Cathedrals still retains the title of the Clerk of the Works. From the quality of the persons above described, we might almost presume that the services rendered were somewhat akin to those of an accountant: the strange mixture of names and officers is most perplexing, and I fear I leave much that requires further elucidation.

During the early years of the Mediæval period, another title obtained, yet so rarely, that but for the one name connected with it, I should scarcely have considered it of sufficient importance for introduction here. The name is that of Elyas de Derham or Berham, and the office that of Director or Master. He is placed by Pugin along with Wykeham and others in his list of the best of the English

Mediæval Architects, on the ground, I presume, of the words by which he is commemorated, as the 'rector' for twenty-five years of the new works of Salisbury Cathedral; at the same epoch, as we are told by the same authority, Leland, 'Robertus Cementarius rexit per vigintiquinque annos.' What shall be understood as to the real meaning of these words applied to the two men?—one, who was Rector the Ruler; and another, who Rexit, was the Ruler also.*

About the same period we find that the works at Windsor Castle were placed under the Direction of William de Burgh, who was succeeded by Walter de Burgh in 1240. This Walter was also Keeper of the manor of Kenyngton, (parish of Sunbury, in Middlesex,) and there are numerous orders from the King for improvements and alterations; also for works at Brill, at Cliff, at Geddington; and he is likewise called 'Keeper of our demesnes.' Under such a title, too, the monarchs were accustomed to appoint a person to each of the royal palaces for its care and preservation, often nominating some old servant to the office as a pensioner.

The last officer to be noticed on the present occasion is one perhaps as important as any of those to which I have yet requested your attention. This is the Clerk of the Works. I have already mentioned how, in an Ecclesiastical establishment, the Keeper of the Fabric, in three instances, appropriated this title as well. We might almost conclude that the title was retained for use by Royalty only, for it so happens that with two other exceptions this designation is not met in connection with any works, other than those executed for the monarchs; one exception is on behalf of a member of the Royal family, and the other on behalf of the kingly Wolsey; the three instances above mentioned appear to show that another name was adopted for this Clerk when in other establishments. The household of the monarch comprised an office for carrying out Royal works. This fact would seem to have escaped the observation of all my predecessors commenting on the histories of the palaces inhabited by the sovereign, as well as by those who have investigated the history of this period. The earliest list of such an establishment which I have yet met with, is that of Edward IV., whose reign comprised the years 1461 to 1483. The manuscript unfortunately is not dated. The Clerk of the Works therein has a fee of two shillings per day, equal to £36. 10s. per annum of the period; a clerk, for whose expenses he is allowed sixpence per day; also four shillings per day for riding expenses, and twenty-pence for boat-hire. The next officer in the list is the comptroller: then follow the clerk of the engrossement of the paybook; the purveyor, with an allowance for his horse; the keeper of the storehouse; the clerk of the check; the clerk of the comptrollement; the carpenter; the plumber; (the mason in this list is omitted); the joiner; the glazier; the surveyor of the mines, who has also £36. 10s. per annum; and lastly, to my great surprize, the Devizor of Building, who has the same amount. The Society of Antiquaries published so long since as 1790, a quarto volume of Ordinances of the King's Household, amongst which is one called the Liber Niger, from a manuscript of the period of Edward IV. Amongst these Ordinances is the following passage connected with the officer under consideration:—"Clerke of the Workes, called by the noble Edward, Clerke dez œvres du Roy, preignaunt sa gages fees et lautres choises appurtenaunte a son office par l'assignement du Thesaurere D'Angleterre de hors le charge de l'oistiel du Roy. This clerke hath no duetie longing to him in this houshold, by vertue of this office outward; but if he be appoynted by the Soveraynes of housholde to take wages and cloathinge with the houshold, it mought cause hym to be the more attendaunt for necessary byldynges in offices in this house; and so he may take lyvery as a squier of houshold." The next list is not earlier than the time of Elizabeth. In these the Clerk of the Works has become the Surveyor and Paymaster, and

* Some other references to him as a Director, will be seen in the Winchester volume, to which allusion has already been made.

Surveyor and Clerk. In 1614 Mr. Basill is the Surveyor; and for the year 1610 there is a list of the household of Prince Henry, in which is the very acceptable name of "Inigo Joanes, Surveyor of the Workes;" the Paymaster and Overseer is Mr. Smith; and the Clerk of the Works, Edward Carter. We here obtain the modern acceptations of the words of office. Later lists of the Royal Household give the name of Inigo Jones, Surveyor: Denham, later still, was Surveyor-General: and Wren, Surveyor of the Works is also known as Surveyor-General. I must not now attempt to enter upon any of the numerous observations arising out of these very important lists in the history of our profession, which exhibit the precursor of our modern Board of Works; but there is one title I cannot pass, namely, that of the Devizor, who has the same remuneration as the Clerk of the Works. Many will remember the conjunction of this name with that of John of Padua, who is usually styled Devizor of His Majesty's Buildings, on the faith of certain patents dated 1544 and 1549, granted by Henry VIII. and Edward VI.; but on referring to the documents as printed, I cannot find the slightest mention of the word Devizor; nor have I been able to discover the name of any person appointed to that office. Vertue or Walpole says, John of Padua's "office seems to intimate something novel in his practice. He was termed Devizor of His Majesty's Buildings. In one of the office books which I have quoted, there is a payment to him of £36. 10s. 0d." To this office book, however, he does not afford any clue; and were it not for the lists I have already quoted, I should have felt inclined to consider the whole as one of his mistakes. Dallaway, in the notes to Walpole in 1826, observes, that John of Padua "acquired a title not before that patent given to any architect;" so that he evidently was not aware of the lists to which I have referred.

I will now refer to the list which I have compiled of those who have held the appointment of Clerk of the Works. The earliest is in 1241, 25th Henry III., when directions were given for certain works at Windsor Castle being done by these officers; similar orders were issued in 1242 and 1244. During the erection of Caernarvon Castle, begun 1284, the Clerk of the Works was paid 8d. a day, and the Master of the Works 13s. a week, or 2s. 2d. a day, the Sunday not included. The Sunday it appears was paid for to such officers who had a yearly salary, as the accounts often mention the 365 days at the 6d. or 1s. per day. A lapse brings us down to 1316, when Nicholas de Tykhull, late Clerk of the Works at the King's Palace at Westminster, was paid £14. and upwards, for certain timber and planks used against the coronation of Edward II. In 1320, John de Ditton was appointed Clerk and Keeper of the King's Works (this recalls the nomenclature of the officer at York) at the Palace of Westminster and at the Tower of London. In 1326, William de Chaillou, who was acting as Surveyor or Supervisor, was appointed Clerk of the Works at both places, which also entailed the honour of looking after St. Stephen's Chapel, then erecting. About three years afterwards William de Kelleseye succeeded him. Both these clerks kept the accounts of receipts and expenditure. Peter de Bruges, in 1347, was Clerk of the Works at Westminster, whilst Weston was keeping the accounts at the Tower until 1351, when Robert de Campsale succeeded him at both places; and he was succeeded by Thomas de Stapelforde, who appears to have been acting previously as Controller. In 1356 William de Lambheth was appointed Surveyor,* and two years afterwards Clerk of the Works. In 1361 William de Sleford was also appointed Surveyor,* and in the same year he was Clerk of the Works; whilst in 1365-6 he is termed Clerk and Supervisor, and was paid one shilling per day.

Returning to the year 1327, I find the Constable of Windsor Castle directed to pay Ralph de la More, Clerk of the Works, an amount for wages at two-pence per day; (as I have before stated, I

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* * Or Supervisor ?

consider this a mistake for two shillings). No other mention has been found of such an officer at Windsor until 1361, when William de Mulsho was appointed Clerk of the Works at Windsor and elsewhere. After him we have Adam de Hertyngdon in 1366. In 1370 Robert de Sybthorp was Clerk of the Works at Shene, Eltham, and Rutherhythe; Henry de Mannesfield, at Childerlangley; John Edward, at the Castle of Ledes; Richard Bernard, at the Castle of Odyham; and Richard de Blore, at Quenesburgh Castle,—all royal property. I must not forget to mention here William de Wykeham's appointment, for five months only, at the manors of Henle and Yeshampsted in 1356. In 1382 Arnald Brocas was Clerk of the Works at Westminster, the Tower, Windsor Castle, and divers others of the King's Castles and Manors. In 1395 John Godmanston was Clerk of the Works of the King's Great Hall at Westminster, although Strype and Stow state that John Boterell was the Clerk; but as there appears to be a slight error in the date of 1395 for 1397, he may perhaps have succeeded Godmanston. On the 12th July, 1389, Geoffrey Chaucer was appointed a Clerk of the Works, his patent mentioning not only Westminster and the Tower, but also Berkhamstede, Kenyngton, Eltham, Claryndon, Shene, Byflete, Childerlangley, and Feckenham. On a careful consideration of the Life of Chaucer, by Godwin, I cannot find any circumstance to warrant a supposition that he was so eminently acquainted with building operations as to be qualified for the practical duties of the office: the short time he held it affords some grounds for the supposition that he had not the requisite knowledge; and the permission to appoint a deputy, would also lead one to the same inference. The period too at which the office was given to him strongly marks the favor of the King bestowing, on a favorite, a gift for good services rendered. John Gedney, his successor, 17th June, 1391, also appears to have been allowed to appoint a deputy; and he is the first Clerk of the Works I have found recorded as having had a certain quantity of cloth given to him for a livery. In 1407 this officer was Henry Merston, who also had a livery. From 1411 to 1413, Robert Rolleston's name is met with as acting at Westminster and the Tower. He was succeeded by John Straunge in 1413, who is recorded to have received his livery in 1416, and as being engaged at Shene Palace in 1413 and 1418. In 1422 John Arderne held the office. In 1440 William Lynde, as early mentioned herein, was Clerk of the Works at the College of Eton. In 1445 William Cleve, 'the King's poure chapeleyn,' petitioned for the payment of £1000 for works done at Eltham, Shene, Westminster, and the Tower. John Canterbury was Clerk of the Works at the commencement of the erection of King's College Chapel, Cambridge, in 1451, having previously been engaged at Eton as Lynde's successor. In 1474 Thomas Canceler held that situation at Windsor, where he had £10 per annum and a livery: in 1483 his accounts were ordered to be determined. In the early part of the reign of King Richard II., Thomas Hunt was appointed Clerk of the Works for life; and in 1484 Thomas Danyell is named. A lapse of some sixty years brings the date down to about 1550, when Eustace Mascall was Clerk of the Works to Cardinal Wolsey at the building of St. Fridiswide, in Oxford, (this is one of the exceptions in the use of the title), and who was for seventeen years Chief Clerk of Accounts for all the buildings of King Henry VIII. within twenty miles of London. From 1555 to 1558 Richard Woodward is named as the 'Clearke of the Honor and Castle of Windsor.' And, lastly, in 1575, Humfry Michell, the Clerk of the Works at the Castle, asks leave to resign his office on account of the difficulties and opposition met with in discharging his duties, and the delays in procuring money and passing his accounts. Most probably he was acting as the Clerk of the Works as now understood. The effects of this remonstrance appears to have been his appointment as superintendent of all payments for repairs done to the Castle, under a warrant from the Constable, the Earl of Leicester, who at the same time nominated Henry Hawthorne to be Surveyor of the Works. The salary of each of these officers was two shillings per

day. There is much similarity in the office held by Wykeham to this appointment of Michell, as superintendent of all payments for repairs done. In this case, however, Michell was under the Constable; in Wykeham's case, by his second appointment, Wykeham was also the Constable, 'capitalem custodem et supervisorem.'

The second exception, which I mentioned at the beginning of this division, comes under the date of 1435; the Clerk of the Works is once named in the contract for the erection of Fotheringay Church for the Duke of York, in the paragraph, "And yf so be that the seyd Will. Horwode (the freemason or builder employed) mak nought full payment of all or any of his workmen, then the Clerke of the Werke shall pay him in his presence, and stoppe als mykyll in the seid Will Horwode hand, as the payment that shall be dewe unto the workemen comyth to;" clearly showing what was at least one part of his duty.

Among the foregoing observations will be found, I think, an elucidation of some points hitherto generally considered obscure. The salary of the Clerk of the Works has been considered exceptional, whereas I have shown that it existed for many years, and at nearly the same amount. Sir Christopher Wren received £45. 12s. 6d., the usual fee for the office of Surveyor-General being, for himself, at two shillings a day, and a Clerk at sixpence a day; a sum now equivalent to about £150. If I mistake not, it has always been considered that the livery of this Royal officer (withdrawn temp. Charles I.) was first given to Inigo Jones, whereas it was a customary present some 150 years previously; and at the burial of King Edward VI., the Surveyor of the King's Works had seven yards of cloth, and each of his three servants three yards.

There is one circumstance respecting nearly all these officers which perhaps needs a passing comment. It will have been remarked how very many of them were either Ecclesiastics or were rewarded with Ecclesiastical preferment. But it must be remembered that, during the period to which our attention has been confined, the Church was the only field for exertion open to those of the nobility and gentry who were not inclined to embrace the profession of arms; and also a means by which to obtain remuneration for a livelihood; therefore, the clergy so called, would thus secure the offices at the disposal of the monarch and of the nobility. Some few, however, of those thus employed, appear to have been unconnected with the Church.

It is very difficult to understand clearly the duties of these officers. The Overseer would be, perhaps, the most easily explained; but his Latin designation, as used in the Records, is unknown to me, unless the Latin word "Supervisor" has been the one our translators have found. The English word Supervisor, if that of Steward be questionable, is I think, best kept for those who, acting on behalf of others, as Wykeham for the Monarch, have yet no grounds to be considered the designers of the building. The Master of the Works, a designation used in the Monastic establishments, whilst in Scotland it took the place of the English King's chief professional man, was, I feel certain, one of the talented advisers of the day. The English King's Clerk of the Works clearly stood in the place of the Architect. The Master or Keeper of the Fabric was probably the keeper of the whole structure; and the Keeper of the Works was, perhaps, only the custodian of the particular works then in progress; the edifice under those circumstances being developed by the Master of the Works, or by the Master Mason, to the latter of whom I may perhaps be permitted to return on a future occasion. But there is one title in the list of the Royal Establishment of whom we should desire to know much, but of whom, at present, nothing whatever is known; I mean, the Devizor of Buildings.

POSTSCRIPT.—Whilst this paper has been in course of printing, my attention has been directed to a passage in Hunt's Tudor Architecture, 1836, p. 24, who states that "it appears, indeed, that in those times the 'Devysor of the Works' acted invariably under a Supervising Officer, who, leaving the artist's fancy and genius unshackled, controlled and restrained the expenditure of money." This latter is exactly the position held, I consider, by Wykeham at Windsor. Also, that "it was common to depute the superintendence of buildings to Churchmen, from an idea of their superior prudence and probity," quoting Warton, (History of English Poetry, 1774-81,) who also states that Wykeham "is supposed to have recommended himself to Edward III. by rebuilding the Castle of Windsor. This was a recent and notorious instance," (alluding to Wicliffe's Sermon, and see note p. 45.) "But in this appointment," he continues, "the King probably paid a compliment to that prelate's singular talents for business, his activity, circumspection, and management, rather than to any scientific and professed skill in architecture which he might have possessed. It seems to me that he was only Supervisor or Comptroller on this occasion." "Mr. Dallaway," adds Hunt, "without mentioning his authority, says the name of Wykeham's superintending architect was William Wynford: assuming this to be correct, Warton's is a fair inference." So that I have not the merit of originating the suggestion, 'Was Wykeham an Architect.' Whereas, "It is to be lamented," writes Gwyn, in 1766, "that Wykeham did not pay more regard to the science to which he owed the greatness of his fortune, by establishing a foundation for the study of his own art, and others that depend upon it. Had he fortunately done this, there is no saying what the consequence might have been: possibly by this it would have been the fashion for ingenious men to come from Rome hither to perfect themselves in the arts, and have bartered Italian for English performances."

Note.—The Lecture has been condensed to suit the limits of space allotted to each Paper.

The PRESIDENT observed that the subject was a most important and interesting one. Mr. Papworth's conclusions had somewhat dethroned William of Wykeham from the position which he (the President) had supposed him to be entitled to. They would remember the statement that Wykeham became a favourite with the King, for his skill in designing alterations at the Castle of Winchester. He was originally held to be an illiterate man, as every man then was who was not a member of the Church; but his knowledge and policy raised him to the rank of an ecclesiastic, and finally to the office of Chancellor. If Wykeham did not absolutely design the works ascribed to him, he was evidently an able judge of the merits of those persons who were able to carry out his views; and his policy as ambassador to France shewed his knowledge of all the machinations of his age, whilst his skill in the construction of Queenborough Castle showed that he knew how to meet them. The Meeting must feel greatly indebted to Mr. Papworth for his learned and elaborate researches.

The Rev. MACKENZIE WALCOTT said that, as the most recent biographer of that great man, William of Wykeham, he had made extensive researches, especially among the archives of his College, and the MSS. in the British Museum; and could come to no other conclusion than that Wykeham was one of the greatest of English architects. He addressed them as the champion of Wykeham, and seriously deprecated any attempt,—upon mere hypothesis and conjecture, or without the soundest foundation,—to wrest that wreath from the brow of the dead which had cost so much patience and self-sacrifice to obtain. Mr. Papworth, he considered, had mentioned "supervisors" as inferior to "clerks of the works" but it was not very probable that Richard Beauchamp, Sir R. Bray, and Dean Alcock were inferior to their clerks of the works. He almost thought Mr. Papworth had mistaken the identity of William; the name in the circular convening the meeting, was "Wykham," and he had said that Wykeham was born at Wickham in *Wiltshire*, whereas he was born at Wickham in *Hampshire*. The objection to the word "*clericus*" was untenable, as "*clericus*" did not imply that the individual was a clergyman. To prove that Wykeham was not a Freemason; Mr. Papworth had quoted a passage of the time of Henry VI., long after his death. Then he considered that the terms "cœmentarius" and "lathomus," at least, if not "supervisor," were all applied to the same person.

Mr. PAPWORTH observed that he had said he had postponed his remarks on the important word "lathomus" for another occasion.

Mr. WALCOTT referred to the will of Wykeham, where, in assigning the arrangement and conduct of his new works, he used the words "*novi operis facti per me*," which Mr. Papworth had omitted; and argued that, having commemorated his glazier, carpenter, and stone-mason in the east window of his College, Wykeham was not likely to have taken to himself any credit due to others. After showing that Membury had been clerk of the works at the same time that he was a clergyman, Mr. Walcott proceeded to read several Latin records in proof of William of Wykeham's claim as an architect. Among these were a document dated 1407 in the College of Winchester, a contemporary chronicle of John Malverne (1326–94) in Benet College, Cambridge, and a document dated 1367 signed by Mulsho, the successor of Wykeham, and confirmed by the King, referring especially to the new style of architecture of which Wykeham was the author. Upon this unimpeachable testimony he hoped for the unanimous verdict of the Meeting.

Mr. PAPWORTH said he had been quite aware of the documents cited, which in fact had all been printed in Mr. Walcott's very able biography of Wykeham, which he considered did not warrant the inference given to them by Mr. Walcott.

Mr. KERR, Fellow, felt that the Meeting must be much indebted to Mr. Papworth, whose paper was not merely biographical, but rather traced the rise and progress of their profession. The subject was exceedingly obscure, but a great deal of light had been thrown upon it by that gentleman in a very

quiet way, and he hoped he would pursue the subject further, as he had promised. There was now a recognized profession, but they could not tell what had been its substitute in the Middle Ages, or whether the monks or the masons, or any individual, such as John of Padua, had designed any particular system. If he must admit the superior learning of Mr. Walcott on the biographical question of William of Wykeham, he could not forget the superior claims of Mr. Papworth's remarks, applying to themselves as architects.

Mr. Street, Fellow, considered Mr. Papworth's argument was inconclusive, and had been answered by Mr. Walcott. The variety of names applied to superintendents of buildings showed that they were used indiscriminately, and Wykeham had been Clerk of the Works before he was Supervisor. He wished to say a few words in defence of a much earlier and equally great architect—Elias de Derham—whom Mr. Papworth had dismissed in six words, and treated as though he were no architect at all; but Pugin rightly claimed that individual as the architect of Salisbury Cathedral, whilst evidence of his employment elsewhere was afforded by warrants from the King to the effect that Elias de Derham should have the disposition of a new window in the Castle of Winchester, and that he should give directions about painting the Royal Chamber. The work was to be done "Secundum ordinationem magistri Eliœ de Derham" "Cui rex Voluntatem suam plenius Exposuit." Elias de Derham, who was Canon of Salisbury, had been unfairly dealt with by Mr. Papworth in favour of Henry of Cerne, the mason, and Alan de Hereford, the carpenter, whose names appeared in the same documents. Mr. Papworth argued that the "clerk of the works" was the architect; but amongst clerks of the works he mentioned Chaucer, who certainly was not an architect. In France the ordinary term was "master of the works," which was commonly found upon tomb-stones, as at Chalons Sur Marne in A.D. 1257, at St. Ouen Rouen in A.D. 1440, and in the Cathedral at Amiens, as well as in the south transept of Notre Dame at Paris, and the same title was in constant use in England also. In Salisbury Cathedral the architects appeared to have managed all the various works, but as architecture became a more exact science, each tradesman was sent for to do his particular work, the result being a great want of harmony. In the accounts for the erection of the steeple of Louth every shilling was entered, as mentioned in the contracts, but no name appeared except that of the master mason. Most of the great Mediæval architects in France were laymen, as Eudes de Montreuil, Pierre de Montereau, Robert de Luzarches and Thomas and Regnault de Cormont, the architects of the Cathedral of Amiens. In England, however, many were clerics, as Alan of Walsingham and Elias of Derham; and a curious fact in reference to this point had been mentioned by Professor Willis, namely, that when William of Sens, himself a layman, who was conducting the works at Canterbury Cathedral, fell from a scaffold, and was unable to continue them, he entrusted their completion to William the Englishman, a young monk of the establishment, who was able and intelligent, and had attended the works, probably, as Supervisor under William of Sens. M. Verneilh had called public attention to the working drawings traced upon the granite slabs of the roof of Limoges Cathedral, representing exactly the lines of the great piers of the "crossing." Of course it was impossible to say whether the architect had anything to do with this; but it was a curious fact that the Mediæval architects, when represented in effigy, generally held an enormous pair of compasses.

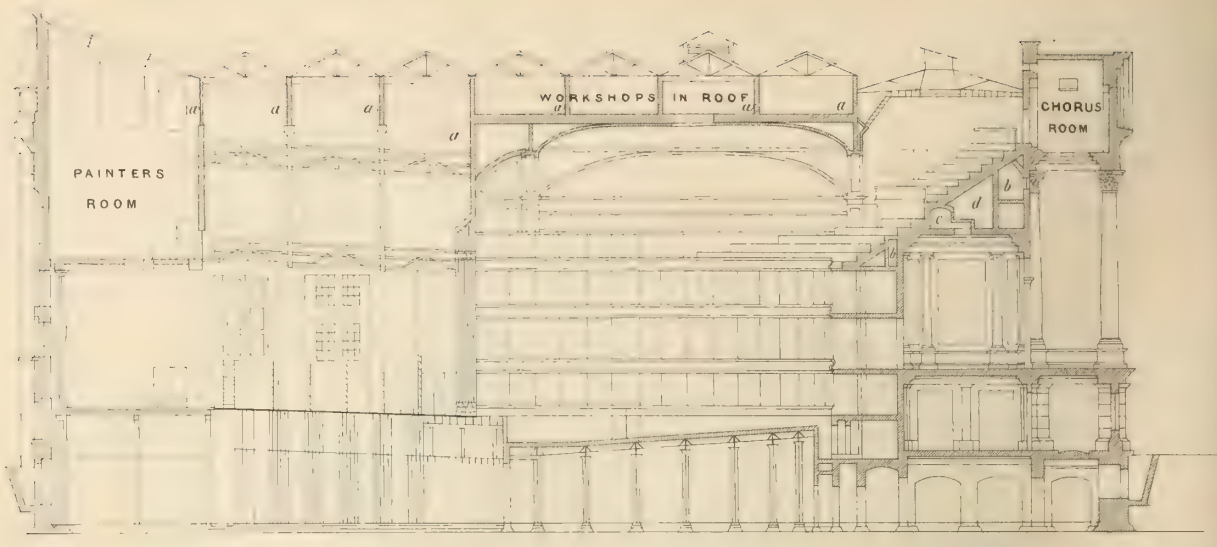
Mr. Ferrey, Fellow, said that, although Mr. Papworth's paper showed great ability, he thought he had not succeeded in establishing his views.

Mr. Ashpitel, Fellow, observed it was true that they often read of edifices erected by men who they knew were not architects, and never pretended to be so. Thus William Rufus is said to have built Westminster Hall, Cardinal Wolsey Christ Church; but the difference in the case, and it was a fact of great interest, was this. William of Wykeham had evidently been brought up an architect, and had made

his way, and won his laurels by the practice of his art; it was comparatively late in life before he took orders, and later still before he shone as a statesman. Now this fact evidenced that the profession of an architect was respected in those days, and was a path to distinction. In truth the use of the word "architect" appeared always to be associated with a high degree of civilization, and an advanced state of art. In rude times the man who stuck a parcel of stones together, and built a hut better than another, would be called the "cœmentarius," and he who built a "carpentum" or a waggon better than another, the "carpentarius." But in the palmy days of Greece he who designed the noble temples bore no mechanical name but was the ἀρχιτεκτων; as among the Romans he was the "architectus" or ruler over the fabric, and we gather from what has been said of Vitruvius that he held equal rank with the juris consulti. As to the phrase which had been quoted "magister operum," this was one of great antiquity and had descended to our own times. Till Sir Jeffery Wyattville had been appointed architect to Windsor Castle, and Mr. Bunning to the City, their predecessors in office had always been called 'Clerks of the Works." [Mr. M. Digby Wyatt stated that though architect to the East India Company, he was still called their "Clerk of Works"] The most important object now appeared to be to ascertain the position of an architect in the Middle Ages, and the estimation in which he was held.

Mr. M. Digby Wyatt, Fellow, said that the question of who were the actual architects of Mediæval times was involved in very great difficulty and confusion, and therefore any attempt to throw light upon it must be useful; and rather than depreciate Mr. Papworth's efforts because they appeared to interfere with what might possibly be prejudices, they should accept most thankfully his endeavours to instruct them.

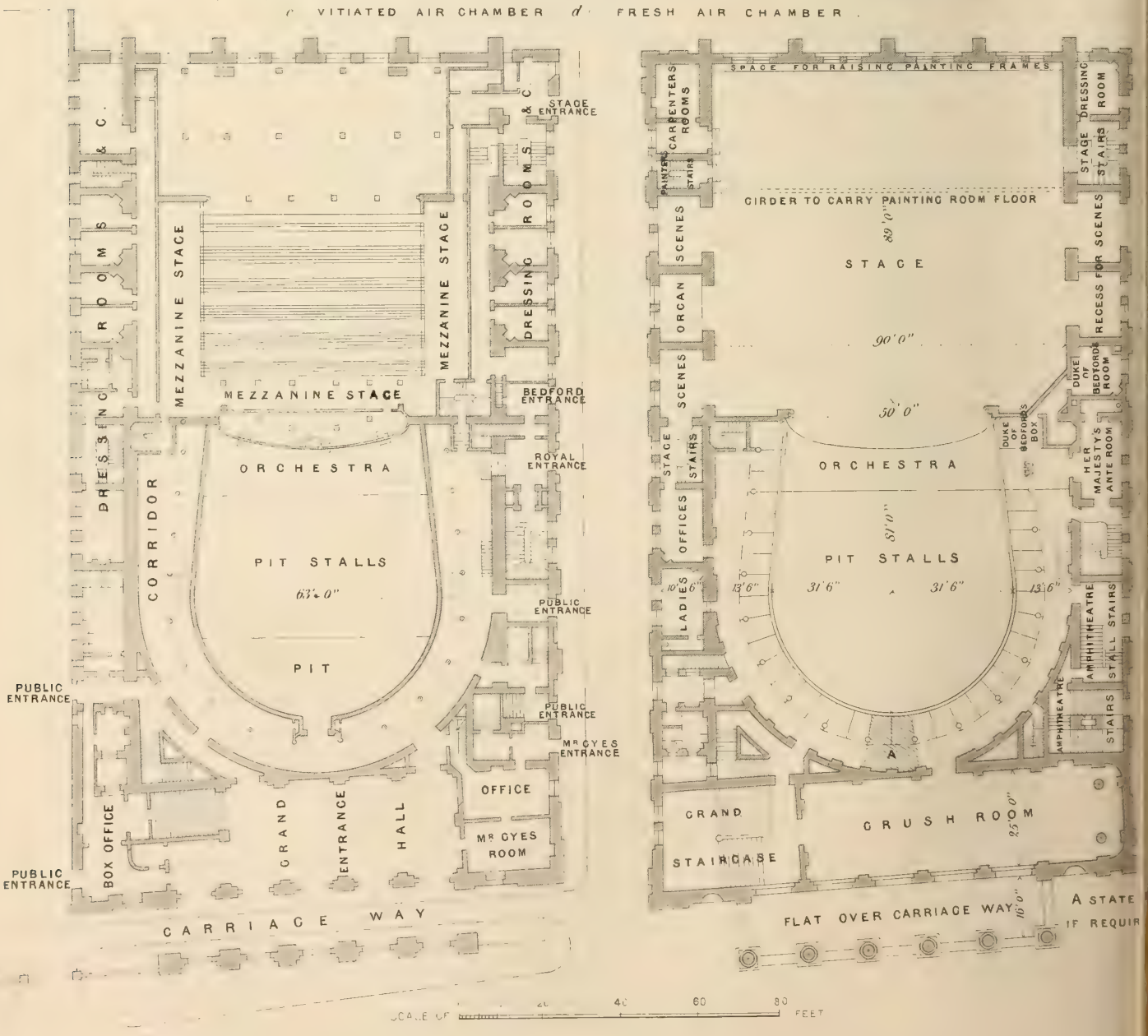
The vote of thanks to Mr. Papworth was then carried unanimously.



LONGITUDINAL SECTION THROUGH CENTRE OF THEATRE

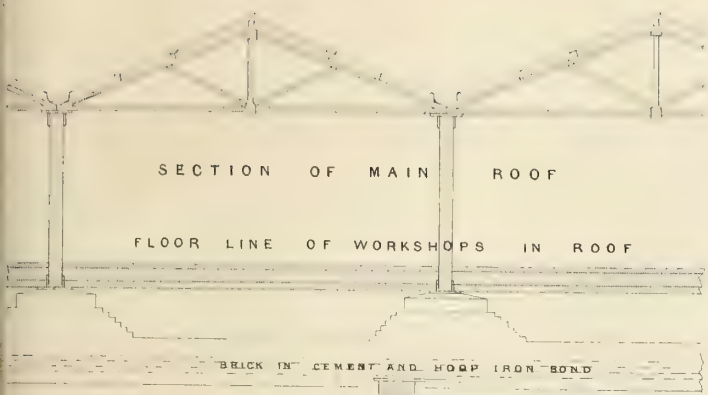
(a a a) MAIN WROUHT IRON TRELLIS GIRDERS 90 FEET BEARING *(b b)* PASSAGES

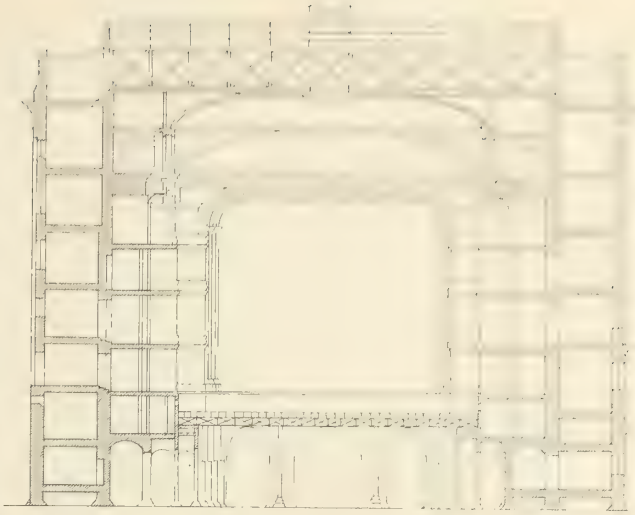
c VITIATED AIR CHAMBER *d* FRESH AIR CHAMBER.



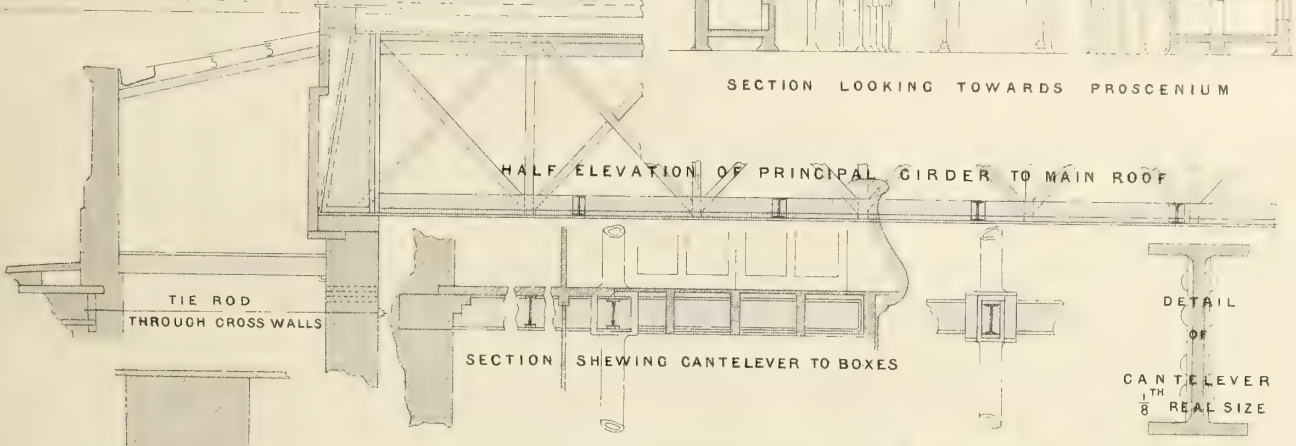
PLAN OF ENTRANCE AND PIT

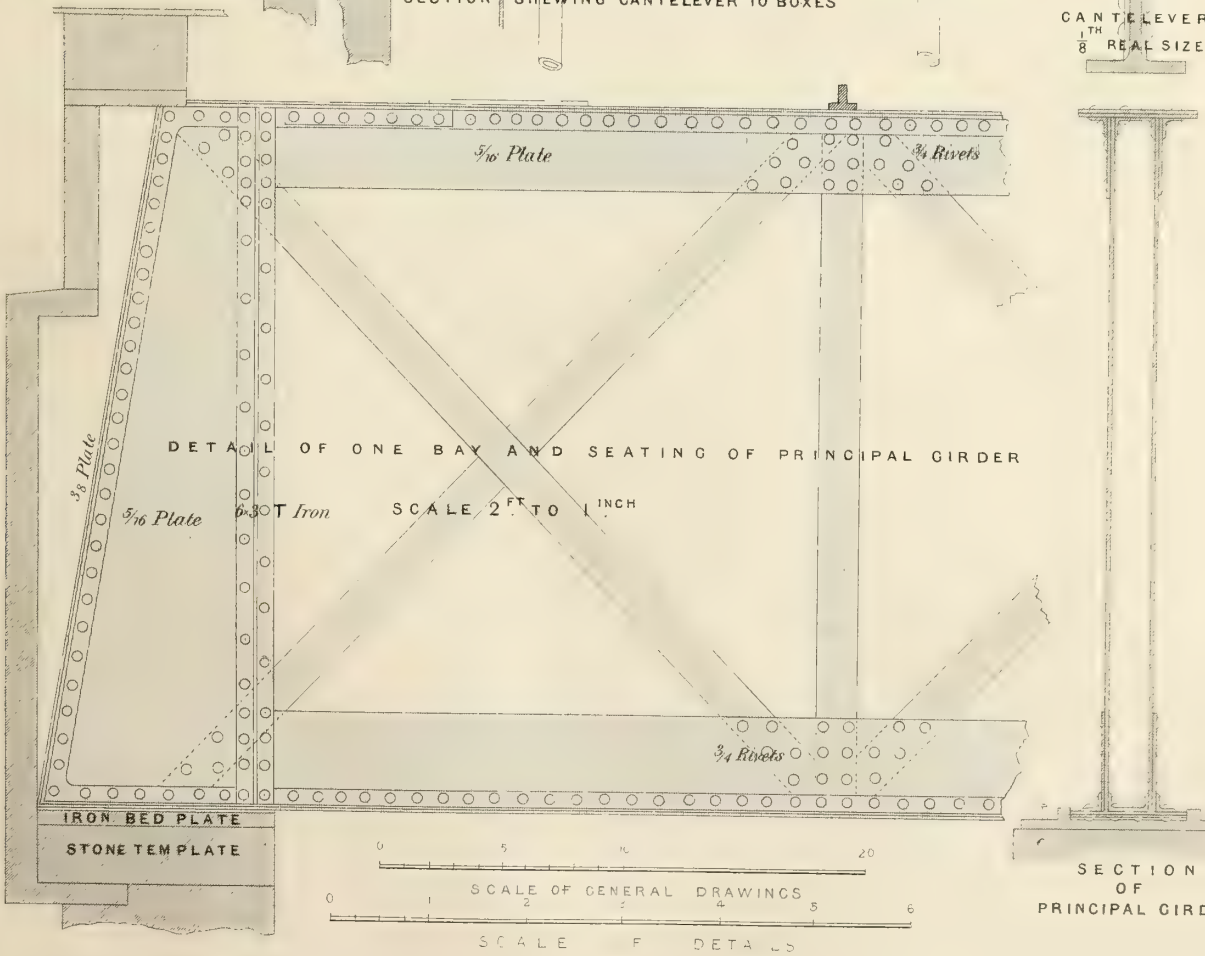
PLAN OF GRAND TIER





SECTION LOOKING TOWARDS PROSCENIUM





DETAIL OF ONE BAY AND SEATING OF PRINCIPAL GIRDER

SCALE 2 FT. TO 1 INCH

SECTION OF PRINCIPAL GIRDER

T. Bedford Lith.

ON THE CONSTRUCTION AND REBUILDING OF THE ROYAL ITALIAN OPERA HOUSE, COVENT GARDEN.

By E. M. Barry, Associate. Read at the Royal Institute of British Architects, February 6th, 1860.

It having been represented to me that some description of the recent rebuilding of Covent Garden Theatre might prove interesting to members of this Institute, I have readily consented to place them in possession, as far as it lies in my power, of all the means adopted to that end. I propose to confine my observations almost exclusively to the constructive features of the new theatre, merely glancing at its architectural character in those cases where its form and appearance have been directly influenced by reasons of a peculiar or utilitarian character; and before I enter upon my description I must, to prevent misapprehension, state distinctly that I claim no novelty or peculiar merit for any of the methods of construction adopted, and if some present may find much to criticise or to condemn, I can only plead that the very limited time allowed for the work often interfered with that calm reflection, and discriminating thought, which are necessary for the production of a noble and enduring work.

Covent Garden may claim to be considered a household word so far as theatrical associations are concerned, a theatre having existed on the site for nearly a century and a half. The first of which we have any record was commenced in 1730, and opened in 1733; the distance from the stage to the back wall of the boxes being 54 or 56 feet, dimensions which were then considered large. It was erected to rival Drury Lane; and from that time to the present a constant competition has been carried on between the two great dramatic houses. After extensive alterations, and a partial rebuilding in 1792, the theatre was burnt to the ground, the cause of the fire remaining, as is not uncommon in such cases, an unsolved mystery. The destruction of the building was complete. The proprietors having decided to rebuild it, fortunately secured the services of Sir Robert, then Mr. Smirke, from whose designs, and under whose guidance, was erected in less than one year, the admirable theatre lately destroyed by the same element which had proved fatal to its predecessor. Sir Robert Smirke's design is so well known that I need not describe it, further than to say that, whatever may be our opinion of the applicability of Greek forms of architecture to the purposes of a theatre, we must all feel that Sir Robert Smirke, while adopting the style fashionable at the time, brought to its execution a thorough knowledge of its capabilities and details, combined with most eminent constructional skill. I mention this the rather because I saw with regret some time since, allusion made to bad construction, as evidenced by the use of wood bond in the walls. Doubtless the use of wood bond in the middle of brick walls is a very faulty mode of building, now very properly discarded, but as regards the bond at Covent Garden the tiers were only on the inside of the walls, and used apparently for convenience in fixing the finishings; and as they were only half a brick wide, the strength of the walls, four or five bricks thick, was but slightly diminished.* In all other respects the construction of Sir Robert Smirke's theatre appeared to me excellent, and the arrangement of arches and voids, of piers and footings, was such as might be most advantageously studied; while the great thickness and solidity of the walls occasioned the contractor for the excavations

* I have been informed that the bond timbers were considered necessary by reason of the rapidity with which the walls were run up; but the architect took care so to place them that on their decaying (the certainty of which, sooner or later, he foresaw) the walls should, by reason of their great substance, not be impaired in strength so as to cause any instability. He reckoned that on the bond timber decaying, the walls would do very well without them, and the result of the fire when they were all burnt out and the walls yet remained standing, proved the correctness of his calculation.

for the present building to wish their construction had been of a less permanent character. The first stone was laid on the 31st December, 1808, by His Royal Highness the Prince of Wales, and a brass box, containing a bronze medal, with the Prince's portrait, and a selection of the current coins of the day was placed under the foundation stone, at the north-east corner of the building, where it was found by the workmen recently engaged in removing the ruins. The theatre was opened on the 18th September, 1809, only 8½ months from the laying of the foundation stone. The cost of the building was, I believe, £180,000,* and on the occasion of opening, an attempt was made by the management to raise the prices of admission about 30 per cent. This was resisted by the public in a manner to which we are happily unaccustomed, and the famous "O. P.," or "Old Price Riots" ensued, and continued about two months. The proprietors were at length obliged to make a compromise, after which the performances were permitted to go on without interruption, and the theatre was used for English dramatic representations until a few years ago, when it was determined to convert it into an Italian Opera House. Extensive alterations were consequently carried out, both in form and size of the auditory, under the professional guidance of Mr. Albano, who gutted the audience portion of the theatre, and rebuilt it according to his own design. The alterations consisted of an enlargement of the auditory, both longitudinally and transversely, and of some modifications of the entrances and staircases. The theatre as altered was thenceforth devoted to the Italian Opera, with occasional performances of other kinds. The fate of so many theatres, however, soon overtook Covent Garden, which in March, 1856, was burned to the ground, while temporarily occupied by the so called Wizard of the North. The fire was supposed to have begun in the carpenter's shop in the roof, but the uncertainty attending its origin has never been satisfactorily cleared up. In noticing the catastrophe it must be felt that the subject of fireproof theatres is one well deserving the attention of our profession. At present, so certain a fate appears to hang over these buildings, that their destruction by fire is almost considered a matter of course. The fires at Covent Garden have been already alluded to. Drury Lane was burnt in February, 1809, not more than five months after the destruction of its rival; the King's Theatre in the Haymarket was burnt some years before; and Astley's, the Strand, the Olympic and some others, have been burnt in our own time. The peaceful pulling down of the old Adelphi, to make room for its present graceful and commodious successor, is an event not often paralleled in theatrical annals. Those who have opportunities of witnessing the working of theatres can be at no loss to account for their danger; but though much peril might probably be removed, there are few places where innovation is less welcome than within their walls, and many prejudices will have to be removed, and many novelties introduced before the public can possess a place of entertainment absolutely fireproof, although much may be, and in fact has been done, both in the New Adelphi and the Covent Garden, to reduce the danger and to protect life.

The spectacle presented by the gigantic ruins of Sir Robert Smirke's theatre after the fire, was very striking. The massive walls and heaps of rubbish, with here and there huge fragments overturned by the firemen, reminded the spectator of some of the ruins of ancient Rome; while the picture of destruction and desolation was enough to cause most men to despair who looked at it with a view to rebuilding an Opera House upon the site. Mr. Gye, however, with characteristic energy and decision, soon entered upon the arduous task, and to his great ability and untiring exertions the public are indebted for the existence of the present structure. The ground landlord, the Duke of Bedford, gave every facility for proceeding with the enterprise, and he has taken much interest in its accomplishment. By the conditions of the lease, his Grace is entitled to a private box and an ante-

* The present new theatre cost somewhat less than £80,000.

room, with a separate entrance from the street. These adjoin her Majesty's box and entrance. Owing to the limited space available in this part of the house, the providing them was attended with some difficulties. The ante-room is in the portion of the house behind the curtain, and connected with it is the ducal box by a covered bridge thrown over the corner of the stage. The design of the building had also to be submitted for his Grace's approval; and it was made a condition that the exterior should be covered with Portland cement. It will be readily understood that many difficulties had to be encountered before so large a work could be commenced under private management; but all was at length arranged, and in the autumn of 1857, Messrs. Lucas, the general contractors, and Mr. H. Grissell, the contractor for the ironwork, were enabled to begin their operations.

Before describing in detail the construction of the several parts of the new building, it may be useful to glance at the general principles which guided its arrangements, and in some measure determined its design. After so dire a calamity as that which had befallen its predecessor, it was determined to carry out a system of fireproof construction wherever practicable; and though it is, perhaps, hardly possible at present to render a theatre actually fireproof, the new building is an advance in that direction. The Building Act most properly requires all corridors and staircases in such structures to be of incombustible materials; and these requirements were of course observed. In addition, as it had been noticed in previous fires, that the roof served as means of connexion between the stage and the auditory,* it was sought to avoid this source of danger by making the roof and its covering fireproof; and it was decided to use as little wood as possible in the construction of the interior. The danger of staircases with well-holes in public places being acknowledged, all those to be used by the public were made to consist of solid stone steps built into a wall at each end; no winders were allowed, and the well-holes were filled up by walls carried up from the bottom, after the custom common in Italy, which, from its advantages to the stability of the edifice, as well as to the safety of its occupants, appears well deserving the attention of architects who provide for the reception of large crowds liable to sudden panics. The shape of the auditory was a matter of much consideration, the faults of a horseshoe shape being obvious in regard to the position of the side boxes. Plans more or less approaching to a circle or to an ellipse were tried and laid aside, and different schemes of arrangement canvassed. The result was, that the horseshoe form was at length resolved on, notwithstanding the disadvantages above alluded to. The requirements of a London theatre for the Italian Opera are very peculiar, and differ in many respects from those of an ordinary playhouse. As regards the latter, the great desideratum is, of course, that all the visitors may see and hear with the greatest possible advantage; and so that this be achieved, the relative position of the audience to each other is, comparatively, of small consequence. In an opera house, though similar objects are sought, there are other circumstances to be considered. Thus the Royal box being on the grand tier, the latter is the great resort of fashion, and inasmuch as the rent of the boxes on that tier bears about the same proportion to that of the tiers above, that the rent of a drawing-room floor does to that of a first floor, it is obviously a great desideratum to obtain as many boxes as possible on this level, where it is found that even the side boxes (in spite of the drawback of position) are always eagerly sought for. The system of separate boxes likewise prevents the possibility of gaining accommodation by deepening the dress circle, so as to get several rows of seats. For these and other reasons it was considered that, assuming the

* It has been stated that the entire removal of a cross division wall and arch over the Proscenium at some period, probably long subsequent to the original construction of the building, allowed the fire to spread throughout the roof of Sir R. Smirke's Covent Garden Theatre: certainly had such a fire proof division across and above the roof remained, a check might have been given to the flames, so that the firemen on duty at the house might possibly have subdued them at the first outbreak.

dimensions of the proscenium to be fixed at 50 feet as the maximum, admitting of convenient working, a horseshoe, more or less elongated, was the fittest form in this particular case; although it might possibly be modified with advantage in other structures having less peculiar requirements. The alleged acoustical advantages of a horseshoe plan were likewise taken into account, and certainly Her Majesty's Theatre is an unquestionable encouragement to any architect to adopt that figure in this respect. In the old theatre the Royal box was on the left-hand side of the auditory, but in the new it is placed on the opposite side. It will readily be understood that, facility of access from Hart Street, occasioned this arrangement, which, as it involved a departure from time-honoured precedent, was submitted to her Majesty for approval before the building was commenced.*

Another peculiarity of plan may be noticed, in the crush-room or saloon. This is situated at the top of the grand staircase, and forms an ante-room, through which all must pass on their way to the boxes. The refreshments are served at the further end of the room, instead of being in a separate saloon, inaccessible to ladies. The object sought by this rendering a passage through the crush-room imperative to all was to cause it to be forbidden to none; and the result has fully answered the expectation, inasmuch as all classes of spectators may now be seen resorting to it for refreshment.

It may be observed on examining the plan, that on account of the shape of the site the building is not rectangular; the corners in Bow Street being respectively obtuse and acute. By placing the principal entrance from the crush-room not directly on the centre line of the auditory, facilities are obtained for the formation, when desired, of a grand state box in the centre of the house, by uniting the boxes on either side and the corridor in the rear. The iron beams over the centre boxes are fixed with bolts and nuts, instead of rivets, to allow of their removal, so as to give the State Box the additional height its importance would demand. Access for the Royal party to the State Box would probably be obtained from the grand entrance; but the public could be admitted from the Floral Hall, from Hart Street, and through Her Majesty's ordinary private entrance. It will not escape observation on comparing the plan of the new theatre with that of its predecessor, that although the dimensions both of stage and auditory are larger in the former, the size of the whole building is less. This reduction was caused by the determination to devote the Southern portion of the site to the erection of a building of iron and glass to be called the Floral Hall. Inasmuch, however, as a large stage and auditory necessarily require adjuncts of appropriate capacity, it became obvious that the only way to make up for deficiency of area was to increase the height. There are eight stories of rooms on either side of the main building; in these are placed the green-room, dressing-rooms, lavatories, wardrobes, armouries, music-rooms, private sitting-rooms, and numerous other apartments necessary in a large lyrical establishment. In addition to the space thus obtained, it was considered that important structural advantages were gained, by carrying the side buildings up to the same level as the principal walls, instead of leaving the latter isolated in their upper portion, as is usually the case. Regard being had to the well-known strength of hollow columns, it was thought that two longitudinal walls 11 feet

	Width of pro-scenium.	No. of boxes in each tier.	No. of tiers of boxes.	Width between boxes.	Length from curtain to centre box.	Height from pit to ceiling.
	ft. in.			ft.	ft. in.	ft. in.
* San Carlos Naples.....	53 0	29	6	70	70 0	70 0
La Scala, Milan.....	43 0	41	5	66	88 6	69 0
Theatre at Bologna	51 0	25	5	57	78 0	63 6
Theatre at Turin	42 0	29	6	52	61 0	53 6
Her Majesty's Theatre	37 0	43	6	59	88 0	51 0
New Covent Garden	50 0	36	4	63	81 0	65 6

apart, but connected by frequent cross walls, would possess all the advantages of a series of rectangular columns or piers, if the tenacity and cohesion of their parts could be effectually secured. In good brickwork when perfectly set, this would be the result; but as in the case under notice, the building required to be occupied before the mortar was dry, and the roof and other great weights would come upon the green walls almost before the bricklayers' scaffold could be removed, it was determined as a temporary measure, to assist their cohesion by iron ties passing through the cross walls, and connecting the two main longitudinal ones. These ties were inserted at about every 12 feet in height, and were composed of two-inch square rods, placed 9 inches from each other, so as to avoid the flues, and secured at their ends by screws and nuts to strong iron plates. They have now served their purpose, and the walls being thoroughly dry and the mortar set, are independent of any extraneous assistance. The arrangement and design of the roof called for some consideration. It is customary to place the carpenter's and other shops in this portion of the building, and the ordinary plan is to construct the roof with Queen-truss principals, so as to get as much accommodation as possible between the Queen-posts. The truss used by Sir Robert Smirke was of this description, and deserves most attentive study as a piece of careful and excellent carpentry. From what has been said as to the comparatively small area covered by the new theatre, the importance will easily be seen of gaining as much accommodation as possible in the roof, and it appeared that a system of beams passing from wall to wall, with small roofs between them, offered peculiar advantages as regards space, when compared with the limited area allowed by the Queen-truss arrangement. The iron beams supporting the roof are 96 feet long, and 9 feet deep; the credit of their design is due to Mr. Henry Grissell, who undertook to make, fix, and guarantee them. This he successfully accomplished in an extremely short time; and it is to me a pleasure as well as a duty to acknowledge the obligations I am under to him, as well as to Messrs. Lucas, and the other contractors, for the ready help and co-operation they were at all times ready to afford.

The beams are of the description known as trellis, in eleven compartments. The flanges are composed of a combination of angle iron, wrought-iron plates, and a section which may be called double ⌊ iron. The diagonals in compression are composed of double angle bars, each 6 by 3 inches; the diagonals in tension are formed of double flat bars, varying from 7 inches by $\frac{1}{2}$-inch to 7 inches by $\frac{1}{4}$-inch. It was considered that the open box form of the upper and lower flanges would give a considerable amount of lateral stiffness to the girders, and that by the adoption of the trellis form a lighter and more convenient girder could be obtained than by using one with a solid web plate. The necessity before alluded to, of using the roof as workshops, determined the depth of the girders, which it was found could not be less than 9 feet without causing inconvenience to the workmen, and the facility of passing through the girders, wherever necessary, was also thought a desideratum. Accessibility of the various parts for the painter's brush, was also obtained; a great point where wrought-iron is used, and the importance of which, considering the great tendency of this material to rust, is, perhaps, hardly sufficiently recognised. There are eight main roof girders, 21 feet apart; on the top of each is a cast-iron gutter 16 inches wide. Wrought-iron principals of the usual character, and 21 feet span, connect the girders together and support longitudinal purlins of T iron, and the whole is covered with slab slate, $\frac{1}{2}$-inch thick, with laps and fillets constructed in the ordinary manner. The workshops are lighted by skylights in the apex of the roof, which, with the exception of the necessary woodwork of the skylights, is thus of an incombustible nature. As the girders occupy the whole side of the workshops, it became necessary to consider how large pieces of framing made in the shops could be lowered to the stage; the interstices between the vertical struts and diagonals of the girders only allowing pieces of small size to pass through them. This object was attained by

fixing the girder immediately over the proscenium, its own depth lower than the others; advantage being taken of the necessity for a sound reflector at this portion of the ceiling. On the top of this girder two cast-iron stanchions are fixed, carrying intermediate girders, and the roof and three spaces, 25 feet, 40 feet, and 25 feet wide, are thus left open to allow of the passage of bulky articles. The girder at the stage end of the building is 30 feet from the wall, and the space between is covered by a lean-to roof, also of wrought-iron, with a large skylight over the painting room. A lean-to roof was here adopted, as giving the maximum of height to the wall on which the painting frames hung, and readily allowing abundance of light to fall at a proper angle on the same. There are no floors between these girders over the stage, and the scenes can therefore be raised as high as the tie-beams of the 21-feet span roofs. The weight upon the girders is, as may be supposed, very great, being estimated at 150 tons for each. Before any were fixed, two were placed side by side, at Mr. Grissell's works, about 9 feet apart, on balks of timber resting upon brickwork and concrete.* Cross pieces of iron were introduced between them to act as stays or braces. Pig-iron to the amount of 300 tons was then heaped upon the girders, an occupation which consumed several days. They were constructed with a camber of $2\frac{1}{2}$ inches, and, when the weight was on, a deflection of $1\frac{7}{8}$-inch was observed; on its removal, a permanent set was found of $\frac{3}{8}$ inch in one girder, and $\frac{1}{4}$ inch in the other—a result probably attributable to all the parts having been brought to their bearings. It had been my intention to allow the weight to remain on for ten days, but after it had been on for 24 hours, signs of weakness appeared in the wharf wall immediately adjoining. The pig-iron was, therefore, removed in all haste, but the result of the proof was considered so satisfactory, that all the other girders were constructed like the two first, without any alteration. During the week before last, I again tested one of the roof girders, to ascertain whether two years' of work had produced any effect; I found the camber reduced to $1\frac{5}{8}$ inch, showing a set of $\frac{7}{8}$ of an inch. Having now described the construction of the roof, and leaving the mode of fixing to be explained presently, it may be as well to point out some peculiarities of construction resulting from the determination to render the theatre available for other purposes than those of the Italian opera.

The arrangement of the theatre for the latter is so peculiar, on account of the special requirements before alluded to, that it is not suitable for other performances without considerable modifications. In rebuilding the opera-house, however, Mr. Gye resolved that it should not be erected with a view to one destination only, and it therefore became necessary to consider how his wishes could best be carried out. The boxes being entirely supported by iron beams, cantilevers, and columns, the divisions between them are formed of $1\frac{1}{2}$ inch wood framing, and are all moveable. The backs of the boxes are likewise capable of being removed, so that a portion or the whole of the corridor may be taken into the

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Estimated Load on main roof girders.

	Tons.	cwt.	quarters.
* 10 iron principals of intermediate roof	1	10	8
11 bays of iron purlins	2	3	0
90 feet cast iron gutter	1	8	0
1,980 feet super. of slates, at 8lb. per foot	7	1	1
ditto snow, 10lbs. per foot	8	10	3
Effect of wind	11	18	2
8 transverse girders for floor	4	10	2
Wooden floor and joists	8	0	0
1,800 feet of load, at 100lbs. per foot	80	7	0
Contingency for ceiling, &c.	7	5	0
Trellis girder itself	17	0	0
Total distributed load on each girder, say	150	0	0

boxes if required, in order to form an extended dress circle. On the pit tier, the boxes, with the floors, fronts, sides, and backs, can be entirely taken away, thereby giving facilities for forming a very capacious pit, extending under the dress circle to the semicircular wall at the back of the corridor. The entrances to the theatre are so contrived that they are suited to this arrangement of the auditory without modification, and the whole of the pit floor is so constructed that it can be raised or lowered at pleasure in a few hours.

It has been already stated that the works were commenced in the autumn of 1857. The removal of the old foundations was a work of great tediousness and difficulty, and as the day of opening was even then fixed for the 15th of May in the following year, all were most impatient to see the conclusion of the excavations, which, however, was so long delayed, that portions of the foundations were put in to save time long before the whole site was clear. The first brick was laid on the 23rd of September, 1857, but it was not until the end of October, in the same year, that the whole site was available for the energetic prosecution of the works. Almost all the iron-work, however, was ordered before the footings were completed, and the roof was, in consequence, finished and ready for fixing before the building was more than three parts up. Considering the unfavorable period of the year, and the risk of interruption to the bricklayers by rain, it was resolved to try to obviate this delay, if possible. Messrs. Lucas, accordingly, agreed to furnish all their men with complete suits of waterproof clothing, consisting of coat, leggings, and hood. It was soon found, however, that the walls being built in mortar, could not be prudently carried up during severe rain.

The arrangements for the Auditory are quite independent of the external walls, and the boxes and corridors are, in fact, a separate structure of iron, stone, and wood, erected inside the chamber formed by the main walls of the building. For reasons already adverted to, it was resolved to use iron for this portion of the work; and it may be remarked that *wrought-iron* was used for almost all portions of the construction exposed to danger from fire and severe tensile strains, in consequence of its presumed advantages over cast-iron in such cases. The boxes are supported by wrought-iron cantilevers, formed of two pieces of T iron 5 ins. $\times$ 5 ins. $+ \frac{1}{2}$. These are connected together with connecting web-plates, so as to form a double $\top$; one piece serving as the upper flange, and half the upright web, and the other forming the lower flange and the completion of the web. A specimen was made and carefully tested by weights before its application was resolved on. The floor of the corridor is formed of 3-inch York landings, rubbed on both sides, which thereby form, at small expense, both floor and ceiling. They are supported on rolled iron joists, connecting together the cantilevers, before described, which are strongly let into the wall of the corridors, and have a point of support, distant rather more than half their length, on cast-iron columns placed at the backs of the boxes. The columns are eight in number, in sets of four resting on each other, carried up from the basement. In consequence of the necessity for the cantilevers passing through the columns at the points of support, the top of each column is formed into a kind of box, through which the cantilevers pass, and to which they are safely secured. It will be seen that as the columns rest on each other they cannot yield to superincumbent weight, unless their foundations give way. It was, therefore, felt to be a difficulty that, while the walls would certainly settle—being carried up so rapidly—the columns, remaining rigid and unyielding, would probably cause serious inconvenience, and might, by altering the levels of the cantilevers and beams, expose them to aggravated cross strains. To obviate this danger, it was resolved not to fix the ironwork until the walls were carried up, so as to give as much time as could be afforded to allow them to settle. It was also determined to make the boxes forming the heads of the columns rather deeper than was necessary. The bearing was then brought up to the right level by thin filling-in pieces of sheet-iron; any number of which might be easily withdrawn in the event of

the walls settling, and requiring a corresponding lowering of the beams and cantilevers. It is satisfactory to add that these precautions have never been called into play since the ironwork was fixed, nor has any settlement occurred, so far as I know, since the completion of the building. The number of bricklayers for some weeks exceeded a hundred; and the number of workmen of all classes, varied from a small body at the commencement, to as many as 1,200 during the last few weeks of the works. The joiners' work was prepared at Messrs. Lucas' works, at Lowestoft; the principal portions were put in hand at the time the brickwork was commenced, and all difficult parts were carefully put together on the premises, then carefully taken down, marked, and sent to London. Thus the ceiling over the pit, the combined curves of which needed care to ensure accuracy, was put together, and temporarily supported in Messrs. Lucas' yard, many weeks before the building was ready to receive it. From the limited space occupied by the building, the site of the Floral Hall being still encumbered by ruins, much difficulty was experienced in finding room for the large quantities of materials daily required; and when the time came for delivering the great roof girders, 96 feet long, 9 feet deep, and weighing seventeen tons each, it became necessary to hire a wharf on which they might be stored until they could be received and fixed. The girders were divided into halves for convenience of transit, and in that form were eventually brought to the works. Considering that the walls, 85 feet high, had been carried up in thirteen weeks, during an unfavourable time of year, precautions were thought necessary to ensure, as far as possible, an even distribution of weight upon them, which was rendered the more necessary from the fact that, owing to the peculiar construction of the roof before adverted to, the main girders had not only to carry their own weight and the weight of the roof, but were also required to support the ceiling of the auditory, the scenic arrangements over the stage, and a complete story of workshops. In the old theatre Sir R. Smirke had effectually provided for the distribution of the weight, by placing two wall-plates of nearly whole timber dimensions along the walls; but with an iron construction this resource was of course unavailable, while the iron girder was not only heavier than the wooden truss, but was also nearly one-half further apart from its neighbour; thus adding in every way to the necessity for precaution from the greater concentration of weight on certain points. The mode adopted was, instead of using wall-plates of wood, to carry up twelve courses in cement and hoop-iron, forming thereby a wall-plate of brick and cement. This 3 feet of wall was connected with the external and cross wall by iron ties similar to those before described, and from it six more courses, also in cement, were carried up like footings to the underside of the templates which receive the main beams. These are of stone, 4 feet by 3 feet, and 9 inches thick, and upon them are fixed cast-iron plates, 2 inches thick, carefully fitted to the shape of the lower flange of the beams. These iron plates were found very useful in fixing the beams in their places, as will be seen presently. The operation of hoisting and fixing the main roof-girders was a matter of some difficulty, and several modes of accomplishing it were considered. It was felt that, considering the greenness of the walls, and the absence of cross walls, a sudden blow from any accident in hoisting them might be attended with very serious consequences. Moreover, the length of the beams being 96 feet, and the space between the walls only 90 feet, it was obvious that they could only be hoisted in an oblique position, if raised whole, and such a course would entail great difficulties in getting them into their permanent places. It was consequently determined to raise them in two pieces (in which condition they came to the works,) and to rivet them together on the top of the building. In a central position, now occupied by the proscenium, a scaffold, about 30 feet by 20 was raised, and floored over at the same level as the top of the walls. The half beams were then raised and placed temporarily, so that the two ends rested on the walls, and the divided centre portions were supported on the scaffold, which resembled a gigantic table. Small portable forges were then supplied on the scaffold, and the half beams were riveted together in the position

described, the whole operation taking about three days to effect. The beam then required to be moved to its place, and room made for the others. Great caution was used in moving the beams, to avoid exposing them to any severe cross strains, which, by deranging their parts, might materially injure them. It was necessary, therefore, that they should be moved, evenly and easily, both for their own sake, and by reason of the state of the walls. To effect this, whole timber was laid upon the walls, longitudinally, and an iron rail fixed on the top of it. Carriages, with flanged wheels running on the rails, were placed under each end of the beams, and a very moderate force applied to them, caused the great mass to move along the walls with the ease and smoothness required. As soon as a beam was moved from the scaffold, another took its place, and before the latter was riveted, a third was hoisted, ready to occupy the scaffold as soon as vacant. Thus, the three operations, of fixing, riveting, and hoisting, were all pursued together, by different gangs of men. We have now accompanied the beam to its position, but we have not yet seen it placed in its permanent resting-place; to do which, without a jar to the walls, and with perfect accuracy, was an operation requiring some delicacy. As the whole roof is so connected together, both with floor beams, and roof principals, all of which were made at the same time as the trellis beams, and were fitted to them to the 1-20th of an inch, any, even trifling, inaccuracy in fixing the latter would have produced serious difficulties. The iron bed-plates under the ends of the beam were therefore fixed in the stone templates with great care; they were provided with a hole through them, under the centre of the beams, tapped for a 2-inch screw, and a corresponding hole was drilled through the stone template. Several courses of the brickwork under the stone template were also temporarily left out. The screw was then introduced from below, and passed through the carriage under the end of the beam, which was carefully adjusted directly over the screw. The carriages were then removed, and the beams left resting upon the screws, which were slowly withdrawn from below, and the beam was finally lowered to its resting place. The omitted brickwork was then made good, and the fixing was complete as far as the main beams were concerned. Care was taken not to surround their ends with brickwork, but to have them free and susceptible of being painted from time to time. The small intermediate roofs, having been all prepared before, were next fixed with great rapidity, and the roofs at the ends of the building were slated and covered in before the beams for the middle portion were even hoisted,—the whole operation of hoisting and fixing the beams having taken only three weeks. The floor-beams between the beams over the auditory were likewise soon in their places; they are made of wrought-iron, and carry the floor of the workshops and the ceiling of the theatre. The chandelier is supported by two iron beams supported at each end by the main trellis beams. It is worked by a crab, and can be raised partially into the workshops, or lowered to the floor of the pit. As soon as the floor was completed, as described, the internal works of the building were pushed forward as much as possible, and the interior of the auditory, then only in carcass, soon began to assume its present shape. It being naturally of the greatest importance to employ as many hands as possible, it was decided not to allow any scaffold to be erected from the ground, but to construct the ceiling from a platform suspended from the iron beams of the roof and the floor in the same. The platform was constructed in the following manner:—Rods of wrought-iron, 1 inch in diameter, were hung down from the beams above, where the aperture, in the centre of the ceiling, would ultimately be formed. From this point, timber beams or joists, radiated like the spokes of a wheel, each beam or spoke being supported at one end by one of the iron rods above alluded to, and at the other carried by a rope strongly fixed to the beams of the floor above. These radiating beams formed the supports of a platform on which the scaffold was erected for fixing and completing the ceiling. The latter is covered with Bielefeld's fibrous slab, which has been extensively used in the large central Reading-Room of the British Museum. It was fixed in large slabs of about 12 feet by 6 feet, and a quarter of an inch thick. In covering the ceiling, it became necessary to shift the ropes supporting the scaffold

to such positions as would not interfere with the decoration, or cause unsightly holes through the slabs. Provision was accordingly made for holes in the ceiling, through which the ropes might pass, not only during the progress of the work, but also at any future time when repairs or redecoration might be necessary. These holes, twenty-four in number, are placed at the joints of the fibrous slabs, and are concealed by plugs let down and removable from the floor above. The ceiling over the pit is a flat dome, 65 feet 1 inch diameter, and 7 feet 2 inches high; this rests upon four elliptical arches, 63 feet 7 inches span, with pendentives. The ceiling over the main gallery is flat, and the two side galleries or steps are covered with arched ceilings, following the shape of the elliptical arches supporting the dome. The dome is formed of purlins in two thicknesses, circular in plan, and hung down from the floor above by wrought-iron rods. The purlins carry ceiling joists in the ordinary manner. The arch nearest to the stage is 10 feet from the curtain, to allow the formation of a sound reflector over the foot-lights and the projecting piece of the stage from which the principal *artistes* commonly sing. The reflector is curved, and follows the form of a parabola. It displays a bas-relief, designed by Signor Monti, representing the ancient and modern drama, with a likeness of Her Majesty in profile between the two subjects. The box-fronts were designed by the same artist, and are executed in the new combination of canvas and plaster, which Mr. Owen Jones has largely used, and has lately introduced to the notice of this Institute.

The decorations of the interior were for the most part carried out under the personal directions of Mr. Gye, assisted by Signor Monti, only a small portion of the *original* designs for this portion of the work having been carried into effect. The whole of the operations connected with the ceiling, such as fixing the carpenters' work, fixing and painting the fibrous slab, and fastening the enrichments in their places, were carried on from the suspended scaffold, and during this time the works below were being pushed on with all despatch. The foundation walls under the pit were built; the iron columns and cantilevers for the boxes were fixed; and carpenters, masons, smiths, painters, decorators, and gilders, jostled each other. Indeed, the interior of the theatre at this time presented an epitome of the building trade, almost every handicraft having its numerous representatives. In designing the construction of the pit floor, a question arose which determined its general character. With a view to render the theatre applicable to all possible purposes, it appeared advantageous to possess the power of raising or lowering the floor on such occasions as public dinners, *bals masqués*, &c. It was accordingly resolved to support the floor on trussed timber beams, 2 feet 3 inches deep, resting on cast-iron columns. These columns have split heads, resembling a musician's tuning-fork. By the adoption of this form the trussed floor-beams can be lowered into the columns their own depth, whenever required; a number of packing pieces filling up the cavity in the top of the column, and retaining the beams at any particular height. An instance of the convenience of being able to alter the position of the pit-floor was shown soon after the opening of the house. From some misconception, the stage had been fixed 9 inches too high, and the occupants of the front rows of stalls had consequently an impaired view of the performers. During the recess, the front portion of the pit floor was raised 9 inches, and the inconvenience was at once obviated. While the works above described were in progress, the stage was in active preparation. Mr. Beverley, the distinguished artist, was consulted as to its general arrangement and mode of working, and the practical realization of his views was confided to the experienced hands of Mr. Sloman. The proscenium columns are arranged to slide on wheels, so as to expand or contract the opening when desired. The grooves commonly used for the support of the scenes are entirely dispensed with, it being considered that their undoubted convenience is more than counterbalanced by attendant disadvantages, and more particularly by the obstacles they offer to the formation of a grand open scene embracing the whole extent of the stage. The back scenes are of single sheets of canvas, lowered from the top, and secured to rollers resting ultimately upon the main

beams of the roof. The side scenes and set pieces are fixed to the wing ladders, behind which the side gaslights for lighting the stage are placed. The wing ladders being unattached to anything above, the artist is enabled to place large set-pieces, such as trees, rocks, houses, &c., against them, and still preserve the total height of the stage, while they are so constructed that they may be moved completely across the stage. The upper pieces of scenery, known technically as borders, are of somewhat novel construction. The great size of the stage rendered it desirable to possess the power of using it to its greatest width, especially for out-door scenes; but as borders to suit such extended scenes would be useless for those of a more limited description, to avoid the necessity for a double set of scenes, it was resolved to make the borders in three pieces—a centre and two wings; the latter being so arranged as to slide forward and back, so as to form an arch of any required diameter. There are two sets of flies, each 8 feet wide, from which the machinery is worked; and there are recesses on each side of the stage to receive the scenery not in use. One of these recesses is occupied by a powerful organ, often used as an auxiliary in operatic performances.

The painting room occupies the ordinary position at the back of the stage; but as the floor is carried by a trellis beam of the same description as those supporting the roof, the stage can be extended entirely under the painting-room without interruption from walls or columns. The painting-room is 90 feet long by 30 feet wide, and 50 feet high in its highest part. It contains several painting frames of different sizes, hung to pulleys fixed to the walls, and furnished with counter-balance weights. The frames are contrived to slide downwards through the floor, so that the artist can readily gain access to any part of the canvas he may desire, without leaving the floor of the painting-room. There is a large skylight in the roof, and the floor is furnished with traps to admit the moving of scenery to or from the stage below. The scenes being necessarily often of a very large size, slits are provided in the stage floor under those already described in the floor of the painting-room, so that the scenes may be lowered even as far as the basement, if required. Under the floor of the painting-room are fixed the contrivances for imitating the noise of thunder, rain, and the like, with the great bell, whose mournful notes have sounded the knell of many a disconsolate tenor. The theatre being intended principally for summer use during the opera season, it was not considered necessary to do much in the way of warming it; but with a view to its occupation in the winter, some artificial means of warmth were, nevertheless, required. A chamber is, therefore, placed under the pit (sufficiently low to admit of the lowering of the floor, before described,) in which hot-water pipes, heated from an apparatus under the grand staircase, are fixed; an air-grating round the pit allows the heated air to escape into the house. The principal exit for vitiated air is through the aperture, 10 feet wide over the chandelier; above which there are openings into the external atmosphere. There are air-valves to the boxes over the doors, and a number of small holes are drilled in the risers of the gallery seats, giving a passage for the air from the halls and corridors to the chandelier, but not in sufficient quantities at any one place to create a draught. There are also air-flues in the corridors and in the crush-room to carry off the products of combustion from the numerous gas-lights; and there are outlets into the roof from the side galleries. None but these simple expedients are adopted, experience having, I think, shown that most elaborate scientific systems of ventilation are liable to failure, more or less complete, in proportion to their greater or less elaboration. A copious supply of water is of course one of the first essentials in a theatre, as a precaution against the rapid spread of fire; for it is clear that, if a fire is to be resisted successfully, it must be so within the first quarter of an hour, as after that time the body of flame would be so vast as to defy all control. The precautions sometimes provided of iron curtains, and the like, are of questionable value, as when most wanted, they are seldom available, or in order; and the only valid precaution appears to be to provide plenty of cocks, with a high pressure

water-supply, in all parts of the building. At Covent Garden there are twenty-five of these cocks, supplied from cisterns in the roof, capable of containing 12,000 gallons. The main cistern is placed over the stage stairs in the north-west corner, towards Hart-street; and in order to secure a constant supply, is divided into two unequal parts, the smaller of which supplies the closets, sinks, and taps of the house, while the larger is entirely reserved for the supply of the fire-cocks, at high pressure. The supply is so arranged that not a drop of water can find its way into the smaller compartment until the larger is full to overflowing. As long, therefore, as there is any water in the closets, &c., it is certain that the fire-cocks are charged; and if by any chance the supply should run short, the inconveniences would be at once felt and remedied. It may possibly be remembered that when the theatre was opened to the public on the 15th May, 1858, the tympanum of the portico was not built, and the removal of the scaffold at this part of the building was not completed until the afternoon of the opening day. It had been intended not to attempt the erection of the portico until the next year, but the inconvenience and interruption to the business of the theatre, that might be expected from a renewal of the works at the principal entrance, having been considered, Messrs. Lucas were asked as late as March, 1858, whether they would then undertake to erect the portico—the columns of which are 36 feet high, and 44 inches diameter—before the 15th May, leaving the tympanum only to be afterwards added. This they consented to do, and on the 27th March the order was given to proceed. On the 22nd April the last capital was set, and the last stone of the architrave was fixed complete on the 8th May, just one week before the opening of the theatre, although the ground at the theatre was then so crowded that every stone had to be worked at the wharf in Lambeth.

The satisfaction, however, of all concerned in the erection of this work was damped by a very sad occurrence. The mason (Mr. Caiger) in charge under the principal foreman of masons (Mr. Hatfield) met with his death on the very day of the completion of his work. He had been promised a present, contingent upon his exertions being crowned with success, and after setting the last stone, he was stepping back to contemplate his work with natural satisfaction, when he took one step beyond the scaffold, from which he fell, and was killed on the spot. Looking to the unavoidable dangers of building and other peaceful occupations, I am not sure that we always do justice to the courage and determination so eminently displayed by our artizans; nor always sufficiently remember the sacrifices and sufferings by which the battles of science are won.

After the portico was completed, iron beams were fixed over the space between the front wall and the colonnade, a beam being placed upon each column. At the close of the season, a platform of scaffolding was formed upon the iron beams, and the tympanum carried up entirely from the same, the space thus formed being converted into a practising room, 74 feet by 14 feet, over the portico, and entered from the back of the theatre gallery.

In fitting up the interior of the auditory, it was resolved to allow each spectator a more liberal share of room than had formerly been the case; the consequence is that the actual number of persons accommodated suffers a corresponding diminution. When the theatre is used for the opera, the number of spectators, comfortably seated, amounts to 2,300; but when otherwise fitted, 3000 or more visitors can be easily accommodated.

There were many sub-contractors employed by Messrs. Lucas for various parts of the work, and all exhibited the most praiseworthy anxiety to complete their task, and enable faith to be kept with the public by opening the theatre on the day named from the commencement. Where all did well, I feel a selection might seem invidious, and as the names of all concerned were published in the *Builder*, I shall now do no more than allude to the clerks of works, Messrs. Allen and Miller, and the foreman of Messrs. Lucas, Mr. Clemence, whose zeal and ability, evinced under most trying circumstances, deserve special recognition.

Professor Donaldson said that, although on entering the room they must all have felt the extreme difficulty of building a Theatre, they would leave it with the feeling that any one of them could do it with great ease. Mr. Barry's modesty was fitly accompanied by the tribute he had paid to those able men who had so well seconded his design, and carried into execution the largest building recently constructed in the metropolis. He had visited the works during their progress, and had been particularly delighted with the simple arrangement of its skeleton framing, and with the manner in which the boxes were united to it by subsidiary walls, so admirably adapted to receive and support the vast weight of roofing,—each part presenting a perfect counterpoise or buttress to resist the thrust which would be brought upon it. The arrangement of the iron work, pillar upon pillar, so as to anticipate any settlement of the wall, or of the foundation of the piers under the columns, was also worthy of attention. Nothing could be more satisfactory than the staircases, which had an effect of perfect solidity and protection in the event of any rush of people from an alarm of fire or any similar contingency.

In answer to a question, Mr. Barry said that the New Theatre had cost something under £80,000.

Mr. T. H. Lewis begged to ask with reference to the Patent Fibrous Slab, and the plaster on canvass which Mr. Owen Jones had also used in his new work in Oxford Street, how far these materials had answered their purpose.

Mr. Barry said that the Fibrous Slab had shrunk a little, so that the joints might be seen, but not more so than any other material would if exposed to the heat of a large chandelier. The durability of the other material referred to remained still to be proved; but in regard to lightness and convenience of fixing it could be hardly surpassed.

Professor Donaldson referred to the table of the dimensions of the principal Theatres of Europe. The Theatre of San Carlo at Naples was exceedingly ugly in its proportions; it was very unfavourable to sound, and appeared to have been erected by hap hazard with regard to its acoustic effects. It was of moderate depth compared with its width. La Scala at Milan, on the contrary, measured 43 feet at the proscenium, 66 feet between the boxes, and 88 feet from the curtain to the centre box, a proportion which was very graceful in appearance, whilst the Theatre itself was altogether one of the most charming in Europe, and the hearing perfect. He further adverted to the Theatre of Bologna (erected by Viviano, the great Continental Theatre builder of the last century), which he described as one of the most beautiful edifices of the kind. Its decorations of white and gold were in admirable taste; but he believed that since he had seen it colour had been introduced with a similar want of taste to that which was too often displayed in other Theatres.

In reply to Mr. Jennings, Mr. Barry explained that the cast-iron gutters of the Covent Garden Opera House were not *fixed* to the girders, but put loosely upon them; which was all the precaution that had been thought necessary to provide for contraction and expansion. These were in one length of 96 feet, bolted together.

Mr. Baker inquired whether the brickwork, executed as it had been with such extreme rapidity, had exhibited any signs of failure.

Mr. Barry said he was not aware of any defect. While the walls were in progress he had used small rods, $1\frac{1}{2}$ in. square, fixed to the walls end to end, by the bulging of which he could have detected any settlement, if it had occurred. On the completion of the work he had the rods shortened and fitted up again, without finding any different result, they had now been all taken away, and he was not aware that any settlement whatever had taken place since the building had been completed.

A vote of thanks was carried unanimously.

ON THE CONSTRUCTION AND MANAGEMENT OF HUMAN HABITATIONS, CONSIDERED IN RELATION TO THE PUBLIC HEALTH.

By Dr. Druitt. Read at the Ordinary General Meeting of the Royal Institute of British Architects, February 20th, 1860.

I propose to bring before you this evening some considerations on the manner in which human life is affected by the construction and management of dwellings. And I do so with the belief that the demolition and reconstruction of a large part of the buildings which occupy the surface of this great city, and the better management of the remainder, are the means through which we may hope to be delivered from some of our common domestic pestilences. Besides, it is evident that when the Legislature confided to your Institute the duty of examining into the professional acquirements of district surveyors, it placed in your hands, likewise, the power of exacting a knowledge of the conditions under which houses are healthy or the reverse; so that whilst, on the one hand, the public would be secured against accidents arising from insufficient solidity, it may also be secured against those slow, and silent, but a thousand times more destructive, accidents which arise from want of sunlight and fresh air.

It is evident that your calling and mine meet at a certain line. I spend my life in the prevention and treatment of disease; you are the constituted heads of the profession employed in the construction of houses. I shall not apologise, therefore, for endeavouring to present a sketch of the natural history of such diseases as may be presumed to arise from misconstruction or mismanagement of houses; and I will not apologise for treating the question in its medical aspects; any practical inferences will be best supplied by yourselves.

Now, in seeking to display the facts of the case, it is evident how masked and complicated they often are, as they exist amongst ourselves, and how desirable it is to bring forward some experiments which shall show them in their simplest form. Such experiments are made whenever a body of men go and take possession of a country, and encamp in the open field, as in the common operations of warfare. Then certain consequences follow as a matter of certainty; and there is no campaign of which we have any record, from that of the Greeks before Troy, to that of our own troops in the Eastern campaign, or that of the Spaniards now in Morocco in which we do not find distinct evidences of them.

Let me, as a fair specimen, turn to the pages of Sir John Pringle, the historian of the medical events of the various campaigns in the reign of George II.; and I choose him because it delights me to give an incidental mark of respect to one of the earliest and most honest observers of these matters, whose opinions, if acted up to, would have rendered Miss Nightingale's labours unnecessary. Let us accompany 16,000 British troops, who in June, 1742, disembarked in Flanders. Their first autumn and winter were not very eventful. They were quartered in various towns in Flanders, and it was noticed that those who had barracks in high and dry situations were healthy, whilst those in low and damp ones, where their shoes and belts rotted, were unhealthy. Their diseases were: various fevers and dysentery, which lasted through the autumn, but ceased with the first frosts of November; and during the winter, colds, coughs, stitches, and rheumatisms. But there was one malady observed during this winter which attracted some attention; and this was a peculiarly malignant and fatal fever confined to the hospital, and seeming to have originated in the foul air of a ward, where lay a man with a mortified limb. So the winter passed; and in the spring the troops marched out, and on the 17th May, 1743, found themselves encamped in an open and healthy country, at Hoechst on the Main.

Then began a regular cycle. During the first three weeks various inflammatory diseases from cold prevailed; pleurisies, coughs, and the like. By the end of June the weather had become very hot; they fought the battle of Dettingen, on the 27th, and encamped on the spot, on wet ground, without straw, for two or three days afterwards. Then dysentery broke out, and Sir John Pringle takes the opportunity of demolishing the vulgar error, that this malady arises from eating fruit. It continued all July and August, and did not abate till the army marched onwards, leaving the foul filth-saturated spot of earth behind them. But mark this. The village of Feckenheim, a league from the camp, was taken up for an hospital, into which, besides the wounded, about 1,500 men were sent, sick with the dysentery. "By this means, the air was vitiated to such a degree that, not only the rest of the patients were infected, but also the nurses and apothecaries, and other attendants of the hospital, with most of the inhabitants of the village. To this acceded a still more formidable disease, namely, the hospital or malignant fever, an inseparable attendant of foul air from crowds, and animal corruption." These diseases combined caused a great mortality in the village, while, such as were seized with dysentery, and not removed from the camp, escaped this fever, and generally did well.

Now, with regard to the army, when they removed to fresh ground the dysentery ceased; but the intermittent and remittent fevers of the country broke out, and lasted till the first frost; when the men became healthy again, till, from increased severity of cold, again came round the winter crop of stitches, coughs and rheumatisms. But no such good fortune awaited the inmates of the hospital. There, no matter what the original malady, they caught the fever, which acquired all the characters of true plague, viz., spots, blotches, and abscesses of the parotid glands. Of the hospital attendants, all were sick, and a third died; of the patients, half died; and of the poor inhabitants of the village, between the fever and dysentery, almost all were destroyed. And now for the last phase. When the survivors from Feckenheim were removed, they were first taken to another hospital, which they infected with their own fever; and then were sent a tedious voyage down the river, in some country barges, to Ghent. There, it is said, and there seems to be no doubt of it, a parcel of old tents, used as bedding on the voyage, were put into the hands of a tradesman to be refitted; and that they conveyed infection to his workmen, seventeen out of twenty-three of whom died.

Here I must leave Sir John Pringle. But without following him in the Scottish campaign of 1745, I have drawn sufficiently from him to show how four classes of effects follow in definite sequence;—First, fevers arising from the condition of the surface of the earth, including intermittent and other malarious fevers; secondly, colds and rheumatisms, arising from insufficient protection; thirdly, diarrhœa and dysentery from insufficient drainage; and lastly, under certain conditions of filth and crowding, fevers of new type, destroying all within their reach, and invested with an intensity which enables them to spread amongst persons not within the original focus.

Now, it is these four classes of maladies, of which we have seen the origin in the definite experiment of a campaign, which in a greater or less degree affect *us*, and which it is the province of the scientific constructor of houses to guard us against specifically. In fact, there are these four questions which should be asked concerning every house:—Is it protected from malaria, or emanations from the soil? Is it adequate as a protection against cold, and does it supply such an amount of fresh air and sunlight as shall be a protection against scrofula and other diseases of decay? Is it so drained that the inmates shall not suffer from diarrhœa and other sewer diseases? And lastly, is it so arranged that it shall not be a breeding place for pestilence, nor yet a lurking place, if it happen to enter from without? I would more particularly urge the necessity of looking at these things always in their relation of cause and effect. If defective construction, and defective drainage, cause such and such evils, then where those evils exist let us look for the causes. If, for instance, a

fall of the thermometer be followed by a rise in the death rate from lung disease, let us consider whether the habitations of the people are such as to afford them adequate protection from cold.

These, then, are the four points to which I shall direct your attention, although it is the first and last only that time will allow me to notice at length. First, then, under the term "malaria" we may comprehend emanations from the earth generally. And in considering houses we should never forget the large, and in some countries, the increasing portion of the earth's surface, which is rendered unfit for human habitation by the emanations from the soil. Well does this fact bear out the Divine admonition to *subdue* the earth, as well as to replenish it; and the other Divine announcement, that bounds have been set to the habitations of tribes of men. But we cannot wonder at it if we think of the myriads of generations of which the earth's surface has been the graveyard; and, that, speak as we may of pure and virgin soils, the whole earth, down to the bare rocks, is full of organic debris, and that our valleys, meadows and marshes are little more than the elevated mud of rivers and estuaries. I will not dwell on the standard facts respecting malaria; that it affects white races in preference to black; that it is lost about 55 degrees north of the equator; that it is intense in proportion to the heat; that it requires moisture, and yet is destroyed by actual floods; and is most dangerous after long droughts, when land previously wetted is nearly dried; and that heat, and stagnant water undergoing evaporation above or under ground, are the efficient elements in its production.

Of the effects of malaria, the most specific in this climate is the intermittent or ague, which in hotter climates and more marshy soils passes by degrees into the pestiferous fever of Walcheren, the remittent of Spain, the Yellow Jack of the West Indies, and the fever which secures the annual apotheosis of an Anglican Bishop at Sierra Leone. Ague is now seldom fatal in London; the Registrar-General gives only 178 as the average mortality of all England from ague during the seven years 1848-54. In Sydenham's time, in the reign of Charles II., the case was different. He speaks of its doing fearful mischief in July and August 1661, whole families falling victims to it. He speaks of it, further, as raging in 1683. But the few cases of ague met with now, attract little attention; so that terrestrial emanations are virtually disregarded. Whether with perfect prudence is another question. For it must be remembered that ague, although the special, is not the only product of malaria. There is besides, in the first place, that brood of most painful illnesses, called rheumatic neuralgia, of which brow or face ague is the commonest type. This flourishes in aguish districts, and can be caught to perfection at Herne Bay (let me say, by way of parenthesis, that the myriad of small flies which infest this place is a sure sign of a swampy situation; and abundance of flies always indicate the presence of neglected decaying organic matter); but the brow ague is present every year in London; and in practice one knows that it affects certain houses or streets by preference. In the next place, it is a property of malaria that it produces the same class of illness which more usually arises from defective house-drainage. Witness the cholera, which broke out amongst our troops in the beautiful but pestilential valley of Aladyn, near Varna, and on board the ships of the Black Sea fleet, and amongst the Spaniards now, in their Moorish campaign. Witness, too, that love of a low level which is a constant feature in the cholera, and which seems to show its alliance with marsh miasma. Dr. Farr tells us that, taking the mean of the cholera epidemics of 1848 and 1854, in London, nearly 15 per 1,000 of those living under 10 feet of elevation died, and 1 per 1,000 of those at the highest elevation; and that, if London be divided into terraces of different degrees of elevation, the mortality from an epidemic of cholera is, in round numbers, inversely as to elevation. Another property of malaria is its power of producing fevers of the continued, or ardent type, like our typhus fever; and here let me observe that anyone who reads the works of the physicians of classical antiquity, or even of our own Sydenham, may well be surprised and thankful at the accounts of constant epidemics, and as they were

called, stationary fevers, or fevers of the country, of which we have no practical knowledge in our happier times. Another point to be remarked in malaria is the remarkable way in which it enhances all diseases of degeneration. The tunbellies, crooked limbs, pale lips, and glandular swellings of the children, and the sickly wan appearance of the adults, at Walcheren, were remarkable.

Again, another point is the power it has of giving intensity to almost any disease, of which the following may serve for an example:—In the years 1805 and 1806, certain regiments which were quartered at Hythe, had an outbreak of ophthalmia, which they had previously contracted in Egypt. They were removed to Dover and other places, without getting rid of it; and on 9th May, 1806, were sent to Riding Street Barracks, twenty miles in the interior of Romney Marsh. Dr. Vetch, who wrote a description of the disease, calls attention to these emphatic facts. The ophthalmia was generated amongst the inhabitants of the marshy soil of Egypt; when brought home, it first appeared in any virulence at Hythe, at the edge of Romney Marsh; at Riding Street, in the centre of the marsh, it broke out with tenfold virulence; it assumed a remarkably mild form when the men were removed twenty-four miles, from Riding Street to Maidstone; and an equally remarkably severe form on the return to Riding Street, when the assizes compelled the men to remove from Maidstone. Now, if we consider these facts with regard to malaria, and remember that London, like ancient Rome, is, as the Registrar-General says, built upon low hills, in the midst of an imperfectly reclaimed swamp; that it was once severely scourged by it; that even now there are occasional indications of its presence; and that it contains in itself the essence of all such diseases as can be produced by putridity and damp, besides those which are special to itself, and that it aggravates all;—the practical question arises, is it not worth while to take even superfluous precaution to get rid of every trace of the evil, and to avoid everything which would tend to create it artificially.

Here it will be well worth asking, are there any present indications of the presence of malaria in London? I believe that it does exist, though generally in a masked form, and undistinguishable from other prevailing sources of illness. Let me give the following instance:—My attention was called to a small cluster of houses, inhabited by respectable tradespeople, and with no want of drainage or ventilation. In the first place, a healthy girl of eighteen years of age died of fever, at No. 12. Two cases of fever then occurred at No. 11. A year afterwards, another case of anomalous fever at No. 12. This year I saw some people from No. 10: the children suffering from diseases of degeneration; the mother told me that last year she had a regular tertian ague, though she had never been out of London. I have long known of these houses, that they stand on the side of a hill, on the very edge of a bank of clay, parallel with Piccadilly, which banks up the water in the gravel behind; and that the basements of these houses are always wet, sometimes flooded; and just the place where, theoretically, ague might be expected. A friend of mine lived at Kilburn for some years with nothing worse than occasional rheumatism, and never anything like fever or ague; moreover, ague was unknown, and fever very rare in the place till, in the winter of 1857-58, a railway was constructed, and an embankment, 25 feet high, made of clay from under Lord's Hill at Hampstead. The first effect was to cut off ventilation and render my friend's garden damp. But so soon as the hot sun acted on this bank, it produced emanations which poisoned every member of the family more or less. The eldest son had continued fever, preceded by great depression, sighing, and ocular spectra; two of the daughters had severe tertian ague; another mumps and slighter ague; the wife and servants were similarly affected; and several cases of ague in Kilburn. It must be remarked, too, that there are ague years, as 1661 and 1683; and in our time, 1827 and 1858, when it prevailed unusually in London. Moreover, there are many instances of the spread of disease which, in the absence of personal contagion, or other common source, we can scarcely help attributing to malaria; and there is no reason to doubt that organic emanations from an undrained soil are similar to those from sewers. Now, it seems phy-

sically certain that malaria may be removed by deep drainage. I do not mean merely the closed pipes and impervious channels by which house drainage and surface water are carried away; but the porous pipes employed by the scientific farmer. The philosophy of the thing is obvious. A constant descending capillary current of water, bringing into it the atmospheric air through a porous soil, provides for the oxidation of all noxious matters. But this oxidation is conditional on free access of air, which the displacement of absorbed water causes. If this were attended to, probably we should have less of the fever which prevails in new neighbourhoods in the outskirts of London, on a clay soil. But as things are, you may see houses erected on a clay soil, covered with stagnant water, which is just concealed by a little made ground. Last summer, too, I saw at Weymouth, a whole row of new houses standing in a swamp. Moreover, in many parts a fictitious elevation is often created by means of made earth and rubbish; itself charged with offensive organic matter. I can point to examples in Gloucester Place, Regent's Park, and Gloucester Road, South Kensington. I may conclude this part of my subject, by submitting to your judgment the opinion, that the preparation of the surface of the ground is a most important point, and the first point to be effected in the scientific construction of houses.

On the second and third divisions of my subject, namely, diseases which arise from imperfect protection, and want of house drainage, I have not time to treat; but whilst discussing malaria, let me say one word on the kindred subject of damp. I have many cases, collected from various parts of this parish, in which mere dampness by itself produced a most singular and uniform train of symptoms; consisting of extreme mental despondency, and accompanied with anæmia and bodily feebleness, and with a tendency to drink and to suicide.

Passing over these matters, I now wish to direct your attention to a matter in which none of us can help being personally interested: I allude to the origin and propagation of the common domestic pestilences, small-pox, scarlet-fever, and others of the group. Consider, in the first place, the number of them. There are small-pox, measles, scarlet fever with diptherite, and whooping-cough, each of which is, so to say, the centre star of a host of satellites, in the guise of chicken-pox, eruptions on the skin, mumps, and others, which, being more frequent and less fatal, are not so much talked about, though they often cause most distressing illness. Now it is worth remarking, that the average annual mortality from these four diseases, in the seven years, 1848-54, was not less than 37,168. The total loss of our army in the Crimean War was under 22,000.

Considering the cause of these diseases, it is too often taught, both by members of my own profession, and by others, that they arise from what is called *specific contagion*, that is to say, that they never arise *de novo*, or *ab initio*, out of filth and crowding, but that they absolutely require, for their development, a germ derived from some preceding case. Of course it will be seen at a glance, that belief, in such a matter, has some very practical bearings. For, if a man believes that scarlet fever can only reach him by contagion from without, derived from some pre-existing case, he will carefully look to his front door; he will exclude suspicious visitors, and perhaps fumigate his letters, and the clothes which come from the laundress; and in doing so he will do well. But possibly he may neglect to see where the air of the house comes from by night, when his street door is closed, and every aperture, by which a clean current could enter, rendered as impervious as possible; and he may neither know nor care that the air of his bed-room enters through an ill-fitting door in the basement, where it has received contributions from a dust bin, from a cellar full of mouldering old hampers and straw, and from a damp coal cellar and servants' water-closet in the area.

Now, partly under the influence of this doctrine of specific contagion; and partly from the fact that these four maladies and their satellites for the most part attack us but once in our lives, the public mind has attained to a wonderful degree of apathy and acquiescence, insomuch that we are accustomed to look upon them as necessary and unavoidable evils, and to think that the annual loss

of 37,000 lives may be lamented, but cannot be helped. If I can succeed in dislodging this doctrine, and rendering it probable to you that they do arise from the same class of causes as did the malignant fever in the hospital at Feckenheim, I shall venture to hope that our time this evening will not have been quite wasted.

Now, in the first place, let me remark that the above four domestic pestilences are members of a very large family of zymotic diseases, some of which were likewise once regarded as specific; but which are now admitted on all hands to be capable of being created wherever the necessary conditions are combined. Take for example typhus, or continued fever, which destroys 17,844 persons on an average per annum. I was reading the other night an essay, by a venerable friend, describing an outbreak of it amongst troops in Jersey in 1806; and he says of the *causes* of fevers, that they are utterly unknown, and locked up in the bosom of the Deity. When, too, I received my medical education at King's College, the Professor of Medicine, known to us all as a most sagacious and benevolent physician, laid particular stress on the doctrine that fever must come by contagion, and that although dirt might create the soil it could not create the seed. But later research has resolved typhus into groups; in one we recognise a fever generated by the vapour of sewers; in another, the product of overcrowding, and so on; and no one doubts now, that, by putting the proper elements together, a fever poison could be bred, as certainly as prussic acid can be formed in the laboratory of the chemist. Let me, in the second place, allude to that group of zymotic diseases which are generated in hospitals; and I do so for the purpose, not merely of showing that these institutions in their degree serve amongst ourselves for laboratories of new diseases, as surely as did the hospitals of Feckenheim, but likewise of paying a passing tribute to yourself, Mr. President, whose papers on hospitals are not the least of your services to humanity. Begin, if you please, with the well-known story, a "Light for the Line," by the authoress of "Hedley Vicars." Thomas Ward, a young navigator, had his arm torn off, and suffered amputation at University College Hospital; and he lost his life because his blood was so poisoned by the hospital air, that it was unable to furnish material for healing the severed arteries. He was advised to leave in order to escape the hospital fever; and went home and bled to death in his cottage at Beckenham. The works of any military surgeon are full of instances of what is called the hæmorrhagic diathesis, generated in military hospitals; in plain English, the patients' wounds bleed to death unless they get out of the hospital air. Numerous, indeed, are the varieties of effect of hospital miasm; you may have erysipelas, you may have pyæmia, a condition in which a patient perishes with universal abscesses, or you may have low inflammation, or diffuse inflammation, all of which can be propagated artificially and reproduce either of the others, and this more particularly if the native miasm of the hospital be aided by a blast of sewer air. Some years ago I witnessed a remarkable operation in one of the leading metropolitan hospitals. The skill and coolness of the surgeon were remarkable. But the patient died of low inflammation. I heard one of the young men attached to the Hospital say, "That patient was in bed 19; every patient in that bed dies after an operation. It receives a blast from the watercloset. I entreated the surgeon not to put this one there; but he does not believe in sanitary measures." But even these hospital diseases sink into insignificance, in all other respects, when we consider the relation which they have to the death of women by puerperal fever, at the very time when they are most the objects of solicitude and affection. No one, not in the medical profession, can have an idea of the painful series of facts which have forced accoucheurs to guard women in childbirth from every source of putrid miasm; and which show that the putrid water-closet, or the ordinary cause of fever, or scarlet fever, may soon rob a house of the mother; and that, wherever generated, the fever may spread; nor how painfully our brethren have learned the necessity of absolutely guarding such patient from every source of contamination. Abundantly has it been

proved that any putrid poison whatever, whether from the diseased living, or from the dead, may originate this fearful scourge, and that, from whatever point putrescence has begun, it may be carried onwards to others.

Still more fully may the source of this domestic pestilence be found in that mistaken and unnatural institution, the Lying-in Hospital. For whole generations has it been known, that what is death to the wounded soldier in the military hospital, is equally death to the poor woman in the lying-in hospital. My friend, Dr. Robert Ferguson, for some years physician to the General Lying-in Hospital, and Professor of Midwifery at King's College, writing in 1839, says, "We have abundant evidence of the disease being most fatal in hospitals. Neither the skill, nursing, nor diet diminish the mortality to a level with that of the out-door population. In her own home the patient is generally better placed with regard to ventilation than in most hospitals, and in no malady is pure air, quickly changed, so requisite as in the puerperal state; it is, in fact, the chief prophylactic. A lying-in hospital should consist either of a series of cottages, or its spacious wards should contain very few patients. When fever prevails, the hospitals should be closed." So wrote Dr. Fergusson in 1838; but General Routine, the oldest commander in the British army, reigns omnipotent elsewhere; and in 1858 the medical periodicals were furnished with fresh accounts of the manufacture of puerperal fever at the General Lying-in Hospital. Dr. Rigby, senior physician to the hospital, showed that from January, 1837, to August, 1841, the mortality of women in child-bed was 76·05 per 1,000. Then a ventilating system was established, and, being obstinately misused by the nurses, whilst the old open windows were in abeyance, the death-rate during the twelve months next after the hospital was re-opened was at the rate of 90·90 per 1000. Then for a period of seven years of perfect ventilation the deaths were reduced to 4·81 per 1000. Again, in April, 1850, the committee determined to discontinue the ventilation, and from this time to May, 1855, thirty women died, or at the rate of 26·77 per 1,000. No evidence can be clearer than that the puerperal fever is an artificial disease, made out of putrid vapours, and that out of the cases in which it appears in private life, some, at least, received contagion from hospitals. I must not quit this disease without noticing that there is a now almost obsolete disease, the erysipelas of infants, which is generated wherever the mothers die of puerperal fever, and that one disease, lock-jaw of infants, is now scarcely met with, even in Ireland. To conclude the catalogue of hospital diseases, I must not omit hospital gangrene, a kind of mortification attended with exudation of a leathery putrescent material, which is constantly generated in crowded military hospitals, and occasionally visit the civil ones. There is a capital experiment recorded by Professor Burgmans, of Leyden. In 1798, hospital gangrene prevailed in a lower ward of a hospital in that city. A surgeon, in order to ventilate it, made an opening through the ceiling into the ward above, and in thirty hours the disease attacked the three patients in the upper ward who lay nearest the opening. Hospital gangrene of a wound, and diptheria in the throat, present the closest analogies.

Next, glancing in passing at the diseases which emanate more emphatically, but not at all exclusively, from the sewer poison, that is the typhoid fever, diarrhœa, dysentery, cholera, and the severer cases of boil and carbuncle, all of which, if severe, are communicable, let me allude to the vast number of diseases of external surfaces which obey the same law as those under consideration—viz., that they may be engendered under certain conditions, and then spread to the healthy. Amongst such maladies are many known to us only by name, although vestiges of them are to be found in Ireland; such as the plica polonica, the button scurvy, sycosis menti, and the leprosy of the middle ages; amongst these, too, are those maladies which are the appointed scourge of incontinence, respecting which the late Army Surgeon, Wm. Fergusson, expresses his belief, that wherever foul and promiscuous immorality prevails, there they will spring up. But let me allude, too, to the Egyptian ophthalmia, which

was the object of much dread and controversy in the last generation. Never absent from the debased peasantry who occupy the crowded huts in the towns on the marshy soil of Egypt, it was brought home from that country by our troops in 1806, and was propagated, and flourished wherever it met with a congenial habitat; it was often noticed to disappear during a march; to be aggravated by close, damp air; but always has been, and is now, certain to appear in Yorkshire schools, workhouses, and barracks, whenever the eyes are irritated and exposed to an atmosphere tainted with human exhalations. But nowhere was this more palpable than in the case of slave ships; and there is an absolute truth in the tale sometimes told by poets, of a ship rolling about at the mercy of winds and waves, because the unhappy captives and the ship's crew were blinded by contagious ophthalmia. Equally true is this with regard to the air passages. Let one or two persons, ill with common catarrh, shut themselves up, and create a vitiated atmosphere, their visitors will, to my knowledge, run the greatest risk of "catching cold."

Another disease, which at times creates an awful interest from its great fatality when communicated to man, is the glanders, a well-known disease of the horse. But, although the effects of the glander poison are as regular and *specific* as possible, yet veterinarians have always maintained that it can anywhere be generated, *ab initio*, under the combined influence of low condition and bad air. The constancy with which it breaks out when horses are sent long voyages is worth noticing.

Let me now remark upon some of the diseases of bygone days—the Hungarian fever, for example, which was said to have been introduced by troops in the reign of Queen Elizabeth, and to have ravaged England from one end to the other; and, still later, at the plague, of which Sir W. Petty, writing in 1683, declares that a visitation of it occurs once in twenty years, and that it carries off one-fifth of the population. Sydenham, treating of the causes of the plague, says they are "matters, like many others, upon which vain and arrogant philosophy speculates to no purpose," and proceeds to "thank the mercy and goodness of the supreme God," because He hath willed that the plague shall occur at distant intervals; and estimates that it visits the British Isles no oftener than once in thirty or forty years; "yet," says he, "when it has done so, its attack has been of more than ordinary severity, and with its full complement of terrors. Moreover, there is always a pestilential condition left for some few years after a great plague year, like the gleaning after harvest, so that all fevers take the plague character; just as in small-pox years, all fevers whatever take a small-pox character." I dare say that when Sydenham wrote, he would have thought it just as visionary to expect to be delivered from the plague, as some of us do from scarlet-fever or hooping-cough. But the editor of the "Collection of London Bills of Mortality," 1759, was able to say, "London has now been free from plague for 100 years. Was it, then, bred or imported?" If imported, why is it imported no longer? The great fire may have destroyed the breeding places, but could not have hindered importation. This is just the question which we ought to put with regard to our four domestic pestilences. Are they bred, or are they imported? And it surely comes within the scope of your profession to consider it; for if, as I hope to show, when they virulently break out in and spread in any house, it is not because they are imported, but generated out of surrounding conditions; then the prevention and eradication of these plagues rests with you. Mind, I do not deny that these pestilences can spread by contagion; quite the reverse. But what I affirm is, that they from time to time arise up here and there *de novo*, out of the malaria, or the defective house-drainage, or the want of ventilation of our own houses.

Now, let me give some instances of the scarlet-fever, or throat-group, including diphtheria, and the varieties of putrid sore-throat, which have convinced me that they are the products of putrid vapour, just as typhoid fever and cholera are. The difficulty of precisely fixing on the very site of an

outbreak in a large town is very great: not so in a remote country seaside village at the extremity of a peninsula, which is emphatically no thoroughfare. Such a village is Swanage, in Dorsetshire, where scarlet-fever broke out some years since amongst the patients of my friend, Mr. Willcox, who gave me the particulars. It began by simultaneously affecting thirteen members of a family, on whose premises a foul cesspool, unemptied for years, had burst. There was no other case for many miles around, till Mr. Willcox carried the infection unconsciously to a poor woman on the other side of a hill, from whence it spread, from one to another, till there were 170 patients and three deaths. When Mr. Willcox was laid up with it the infection ceased.

In Wareham, in 1859, Mr. Willcox distinctly traced an outbreak of scarlet-fever, in a row of small houses, to be emanations from a putrid ditch opposite, which received the sewage of the upper parts of the town. The Inspector of Nuisances of this parish, whilst superintending the opening of a cesspool in a house which had been infected with scarlet-fever, which was examined on that account, was smitten with the emanations, and went home ill with the fever, which began then and there. The first case of diphtherite I ever saw was on the 7th July, 1855, in the person of a lady staying at a private hotel in Dover-street. Her maid and son took the disease afterwards. All were exposed to vapours from a cabinet in their suite of apartments, which ought to have poisoned some one. Three deaths from diphtheria occurred in the winter of 1858-59, at No. 299, Oxford-street, and one in a contiguous and communicating house, No. 17, Hanover-place. Complaints were made that the air of these houses was nauseous in the extreme; and it was found that they stood over a putrid swamp, composed of their own sewage, which had had no means of escape for a generation. All the workmen employed in excavating this, were laid up with severe sore throat. Five deaths of children, and one severe illness of a woman occurred in one house, No. 15, Woodstock-street, in March and April, 1859. All these persons lived in the back of the house; none who lived in the front were ill. In the back kitchen it is reported that there was a current of sewer air of most offensive odour, from an untrapped sink. A remarkable point is, how scarlatina, diphtheria, putrid sore throat, and measles, herd together. If three or four persons die in one house, under different medical authorities; one will return his death as measles; another his as diphtheria; another his as putrid sore throat, and another his as scarlatina. My own conviction is, that each of these maladies, with their congeners, small-pox and hooping-cough are so many products of putrid earth, putrid water, and putrid air festering in the dwellings around us. Last month a party of benevolent gentlemen undertook a sanitary walk through some of the houses of the poor in St. George, Hanover-square. One soon was obliged to leave, the air of the houses made his throat sore. It is constantly observed by those who have to work the sanitary machinery of the Metropolitan Local Management Act, that all these diseases flourish and fade, side by side, and that the accumulating evidence of a common origin is invincible.

Even whilst I am writing this, a friend calls to tell me of the death from diphtheria of the child of a mutual friend, this 17th of February, 1860. I ask the question, is the house healthy? Oh dear no; there is no staircase window; the house is always stuffy, and never can be sweet; besides, the water-closets are within the house, and in some of the bedrooms. Has there been illness before, and if so, in any particular part of the house? Oh yes: amongst the children; they had cholera in 1856; and in April, 1858, there were such symptoms of poisoning amongst the nursemaids and children, that the father of the family sent some of the water to be analysed. No poison was found in the water; but it was found that a constant current of foul air ascended into the nursery, through an untrapped sink from the drain below. The children all look blanched and anæmic. All that professional skill, affection, nursing, and lavish nourishment could effect, was done for the poor child; but the question will occur to everyone, was she not poisoned by the air of the house? and yet the house is new, and the

rent not much under £300 a year. I am unable, from want of time, to adduce more of the evidence of which this is a specimen, in favour of the *ab initio* origin of scarlet fever and its allies; an opinion which has arisen independently in my own mind, and been, as I conceive, confirmed by the inexorable logic of facts. Evidence of the same kind, as there is for the independent origin of scarlet fever, exists also for that of small-pox and measles, although in lesser degree.

In the remarks which I have made, I have confined myself entirely to the medical side of the question, and have purposely abstained from entering into any details of construction or arrangement on which points I should come here to listen, and not to speak. But after full consideration, I determined to confine myself to the natural history of disease, being convinced that every study of nature, whether in her order or disorder, must lead to good results; and that when once it is stated emphatically that, good drainage, fresh air, sunlight, and space, are antidotes to all diseases arising from houses, it is only necessary to bring before you an ample store of medical facts, showing the intensity of the evils to be combated, and you will not fail to devise and apply the structural preventives and remedies. For if it be not known and believed, that hospital gangrene, puerperal fever, and scarlet fever arise out of certain conditions, how can the constructor be expected to take pains to avert them? If it be not known and believed that sunlight and air are necessary to protect children from scrofula, why should not the constructor build a low room with borrowed light for an infant school? and so of the rest. But I will conclude with offering four brief suggestions, arising out of the general view of the subject.

In the first place, your Institute will render an essential service to humanity, not merely if you insist on a knowledge of the conditions which render houses healthy or the reverse, from candidates who are entering your profession; but still more if such a state of professional ethics, or etiquette be cultivated, that designers of houses of every grade shall be deterred, both by conscience, and by a regard for professional opinion, from designing, and from sanctioning such designs of houses or such subsequent enlargement or alteration of houses, as shall render them unhealthy: such as putting five houses where there is room for four only, and so depriving one of air, as is the case of my friend's house, who lost his child from diphtherite. Your professional weight will be well employed in controlling the ignorance and cupidity of the owners of houses. Secondly, I would suggest the expediency of experiments in the construction of houses upon improved conditions. At present our experiments are irremediable, for when the house is built, it cannot be pulled down; but that which is wanted is power to erect experimental houses, such as that described in the Government Report on Warming and Ventilation. For instance, as chemical knowledge increases, we see the folly of sending a large portion of our fuel up our chimneys; and, as towns increase, the air of a wide area becomes daily more contaminated from a thousand causes, and it becomes most desirable to remove not merely the opaque, but the transparent products of combustion, especially the sulphurous acid. In fact, there would be no impossibility in conveying all the foul air out of a block of houses by one channel, and washing it from its impurities before it is allowed to mix with the atmosphere. But for these purposes experiments are needed, which your Institute may procure, but which would be hopeless for private individuals. In the third place, it appears absolutely necessary to utterly remove the old, dilapidated, dark, squalid, damp tenements which cover a large area of this metropolis. Practically speaking, they are perfectly incurable, and they serve only as a nursery of an enfeebled and sensual population. There are houses close by this from which disease is never absent; the soil is sodden with damp and riddled with drains and cesspools; the walls damp, and saturated with the exhalations of years; the wood, decayed and spongy, full of vermin, never looking clean, and, from its porosity, refusing to dry if washed. Such houses are utterly hopeless; and it is evident that it would be a boon

to humanity if the district where they prevail could be razed to the ground, the surface excavated, and then covered with dwellings which would admit the light and air and encourage cleanliness. Lastly, let me say, that looking to the number of the conveniences of life which society intervenes to procure for its poorer members—such as churches, clergy, schools, libraries, baths, washhouses, savings' banks, clubs, hospitals, and dispensaries; relief in destitution over and above the legal pittance; work for the unemployed; reformatories for the fallen; and even protection of the brute from cruelty—it were reasonable to extend the existing machinery for providing houses for the poor, and controlling them. At present we have associations which erect or repair model dwellings here and there, and all honor to them. But we really want bodies whose functions shall be conterminous with every parish, which shall take poor buildings whenever vacant, compete with the present sordid owners of house-property, take, cleanse, improve, and let, poor apartments at such a rate as shall just avoid loss, and find their profit in an improved public health.

This subject, however, must be developed elsewhere. Let me repeat, in conclusion, that the diphtherite, which will occasionally intrude into the best constructed house, if not developed there, is a sign of the existence of houses elsewhere, the sites of which I should be glad to see put into your hands to be covered with new buildings.

Mr. Burnell, C. E., said that the subject of Dr. Druitt's paper had long occupied his attention, and that he entertained views upon it opposed to what he might call the fashionable views on the question. He had lately had a great deal to do with Holland, a country particularly subject to malarious diseases. The drainage of its towns was very defective; but it was not found that the forms of disease, said to attach to a lack of drainage, or to emanations from the soil, were remarkably prevalent there. The ague form existed, but not the typhoid form, nor those diseases, such as hospital fever, gangrene, &c., which were said to be malarious. In the towns of Holland, especially in Amsterdam, the rate of mortality compared with that of England was fearfully high; but he believed this arose more from deficient nourishment and a bad style of living than from any malarious emanations; although he admitted the influence of the latter also. In the large Tanneries of London, the fleshers (constantly employed upon the East India kips, which came here nearly in a state of decomposition), were not subject to a great degree of mortality. Mr. Burnell then referred to Dr. Parkin's "Inquiry into the Origin and Causation of Diseases." In that very remarkable book the author brought forward many instances of the absence of the power to produce disease under circumstances said to be certain to produce it. Dr. Druitt had said that the rate of mortality frequently increased with a fall in the temperature, and he appeared thence to infer that dwellings generally were not made sufficiently warm. But as the occupation of the bulk of the labouring classes was carried on out of doors, too much importance should not be attached to the conditions of the houses themselves. In London the thickness of walls was regulated by the Building Act, and walls so thin as to be objectionable were only met with in country districts. A hundred years ago ague was not only endemic, but epidemic in London. In our own times it had prevailed to a great extent in the fen district, and after a long interval had appeared again within the last two or three years in the neighbourhood of Wisbeach and Ely, apparently on account of a long period of dry weather, bringing up the emanations of the soil from a greater depth. The unhealthiness of Herne Bay might be ascribed to other causes than those assigned for it. Like Ipswich, Croydon, and other places, it was situated upon the out-crop of a permeable stratum, lying upon the edge of an impermeable one, which overlaid it. At Herne Bay the rain-water filtered under the tertiary clays of the London Basin, and in dry seasons there was a considerable amount of evaporation from the surface of the sand-beds. In such positions typhoid

fevers were generally very rife; therefore the local conditions should be taken into account in discussing the healthiness or unhealthiness of houses; and altogether the influence of geology on the question deserved more attention than it had received from either the Architectural or the Medical profession. With regard to the greater prevalence of cholera in low levels, he considered the truth of the fashionable theory doubtful, and believed that the whole action of that disease was involved in so much mystery that it would be dangerous to lay down any law upon the subject. In one year it attacked damp and low places, and in another high and dry positions, and was often more fatal in the deserts of Arabia than in Holland. It was usual to ascribe the cessation of the plague to the Great Fire, which destroyed a large portion of the metropolis; but not only had the plague disappeared *here* since 1666, but throughout north-western Europe generally. Indeed epidemic diseases appeared to have their course. They raged perhaps for a thousand years, and then disappeared as they came, —no one knew how or why. Seneca had long ago remarked that a long peace invariably engendered new forms of disease; a wise remark, and one which, considering the time when it was made, argued a considerable amount of observation upon natural laws. The diphtheria which occurred in places formerly said to engender the plague, might be a modification of that disease, and the pathology of the former might advantageously be studied with reference to the history of the latter. With regard to the illustrations cited by Mr. Druitt, as occurring at Swanage, it appeared that scarlet fever existed already in the house where the Inspector of Nuisances caught the infection, before he had assisted at the opening of the cesspool. Dr. Druitt, after having dwelt exclusively upon the emanations from the abominations prevailing in London houses, had said that disease arose as much from the lack of light and air, and from putrid water, as from those deleterious exhalations,—thus bringing into consideration new sources of evil. London could hardly be considered as exposed to the evil of the use of putrid water. (Dr. Druitt said that he had only referred to the emanations from the putrid water of the sewers.) The remedy for the mischief arising from untrapped sewers was in the hands of the public themselves, and was notoriously caused by the neglect of servants, who either removed or broke the traps whenever any obstruction occurred. The Doctor had said that it was their duty as architects to prevent the construction of a Hospital in a crowded neighbourhood, and upon or close to a crowded graveyard, but he thought this evident allusion to King's College Hospital was misapplied. In that case the selection of the site did not rest with the architect, but with the Council of the Institution, advised by a body of medical officers, whose duty it was (and not the architects') to keep the Council right. Much had been said as to the consumption of smoke, but he thought it would be found that the healthiness of the metropolis depended a great deal upon the comminuted carbon suspended in the air, because carbon in that form was one of the best possible absorbents of malaria. The soil of London was of a nature to create malaria, and it was remarkable that until the consumption of coal became general, ague had been as prevalent in London as it was now in Amsterdam. The personal annoyance from soot was exceedingly unpleasant, but running a tilt against it, as was often done now, was getting into a false course altogether. Dr. Druitt had recommended the pulling down of large blocks of houses, which were unquestionably fever haunts, and the building of new ones. But it should be recollected that whenever that was done the result of the operation would be to substitute ground rent for house rent; and it had been found by experience in the cases of New Cannon Street, and of the Rue de Rivoli, and of the other new streets in Paris, that more than 40 per cent. of the capital expended in the purchase of the ground had been absolutely lost. And even when the existing low-class houses were replaced by new ones, the people who went into them had all the same habits as before. The chairman knew as well as himself that the lower classes,—particularly the poorer Irish, who were less educated than others,—had an utter lack of the

first habits of decency, and a total ignorance of the principle that "cleanliness is next to godliness," or at all events of its practical application. The best and only remedy for these evils was education, and especially female education, which would teach the mother to make the home of the family what it ought to be. At present there was a tendency to do too much for the people, without teaching them to do what they should for themselves. He fully agreed with Dr. Druitt that filth, dirt, foul smells, and everything of that kind were serious and monstrous evils; but the remedy for them rested firstly with the public themselves, and secondly in an enlarged, careful and philosophical examination of all the bearings of the question.

Mr. Haywood, Fellow, said that the subject under discussion formed an agreeable variation to the papers generally discussed by the Institute. He agreed with nearly every word of Mr. Burnell, who had studied the subject with so much care and judgment. He believed he could adduce a mass of facts which would go far to contradict every one of Dr. Druitt's statements. He would not argue that stinks were wholesome, because he believed that a pure unvitiated atmosphere was the normal state for healthy existence; but if the medical theories were to be carried to the extent sought by some, we were almost led to expect that death by ordinary sickness would be annhilated, and people would live until they died of simple old age, which he believed had never yet been the case. When the cholera ravaged Paris in 1832, there was at Montfaucon, outside the Barrière du Combat, a large manufacture of Poudrette, where all the refuse of the city was brought; and although nearly 1,000 people, men, women, and children, worked there every day, that was almost the only spot that was exempt from cholera. Again, the men who worked in the Sewers of London were as free from the class of diseases which their occupation was said to render them liable to as any other class of artizans: and facts like these furnished as good a basis for theory as the repeated deaths from scarlet fever in a particular house where drainage happened not to be quite perfect. It would be desirable to procure statistics of the deaths of people in different kinds of avocations; but he should even distrust the results of such statistics as deduced by some men, believing as he did that the power of fairly generalizing from figures was given to so few that it was almost indeed the rarest gift in the world. He agreed with Mr. Burnell that Dr. Parkin's book was remarkable for the courage which the author had displayed in running counter to the popular dogma of the day. Did anybody know what malaria really was? Dr. Parkin attributed it to volcanic action. That a peculiar condition of the atmosphere, however generated, was the cause of epidemic diseases, there could be no doubt; but he believed no one knew whether it arose from volcanic action, or moisture or bad drainage, or from any other cause. Dr. Druitt had urged that the means of preventing disease was to be sought by an improvement in the structure of houses, and by a due attention to the best means of providing air, light, and heat. These however were unfortunately matters which the architect had oftentimes exceedingly little to do with, compelled as he was to comply with the wishes of his clients. In the case of one of the largest houses now building in the country, where there was no want of funds to prevent its being a model of perfection, the lady of the house positively interdicted anything like an attempt at ventilation; insisting that if ventilation of any kind should be required she would open the windows,—which, considering the repeated failures in scientific plans of ventilation, he was not quite sure might not be the most sensible plan. With regard to the causes of attack of epidemic diseases it appeared to him that the medical profession always ignored the empty stomach. These diseases at one period visited low levels,—at another they visited the higher levels,—at one time they neglected a particular town which they attacked on the next visitation; but at all times these diseases visited the hovels of the poor, selecting them because their stomachs were so empty and their vitality consequently low. He had thought more on this subject than perhaps most non-medical men, and did not offer this opinion

hastily. He believed that if they were to take a thousand poor vagrants, whose earnings were next to nothing, and who spent half of those earnings in gin,—if they were to take them and whitewash them and lodge them in a royal palace, the cholera or any other epidemic would select them as its victims. And simply because the empty system was an absorbent system, and, no matter what epidemic might be raging, it would be sure to attack the empty and absorbent system; and he thought the best possible way of stopping the ravages of epidemics such as cholera, would be by issuing daily rations of good food to the poor. The suggested demolition of large masses of buildings was simply impracticable. Medical men had either objected to everything or been contented with nothing which architects and engineers had done in the way of improvement; but instead of generalizing and suggesting impossible measures he wished those gentlemen would content themselves for the present with pointing out certain remedies adapted to the existing state of the population, and such as the existing laws would permit to be carried out.

Mr. H. H. Burnell, Associate, read the following letter, said to have been written by Erasmus (and printed in Malcom's "Manners and Customs," vol. 2, p. 367), to show that the danger to health from dirty habitations was no novelty. Bad however as the compound of decayed osiers and clay must have been in former days, it could not have been worse than the filthy floors of some modern dwellings.

"First of all, they are totally regardless concerning the aspect of their doors and windows to the East, North, &c. They build their chambers so that they admit not a thorough air, which yet in Galen's opinion is very necessary. They glaze a part of the sides with small panes, designed to admit the light and exclude the wind; but these windows are full of chinks, through which enters a percolated air, which, stagnating in the room, is more noxious than the wind. As to the floors, they are usually made of clay, covered with rushes that grow in fens, which are so slightly removed now and then, that the lower part sometimes remains for twenty years together, and a collection of every kind of filth. Hence, upon a change of weather, a vapour is exhaled, very pernicious, in my opinion, to the human body."

The Chairman said that he had heard with pain the statements which had been made by two such able speakers as Mr. Burnell and Mr. Haywood, and he could not see what possible result could be looked for from such observations. Both of those gentleman admitted that bad air was unwholesome, and that bad drainage was most hurtful; and yet all their ingenuity had been employed in throwing discredit upon those who were desirous of impressing those facts upon the public mind, and to produce that state of education which, as Mr. Burnell had very properly said, could alone provide a remedy. In every town where sanitary measures had been tried they had been attended with most admirable results; and when it appeared that in one city 30 in every 1000 of the inhabitants died in one year, whereas in another small village only 17 in the 1,000 died, it could not be denied, with those facts staring them in the face, that such different results must arise from circumstances within the control of man, and that if those circumstances could be discovered, and proper remedies applied, the lives of the extra 13 per thousand in the cities might be saved. It was known to many gentlemen present that he (the Chairman) had taken some pains upon the subject for several years past. He had visited a great many of those houses in which good health was impossible, and where every one who lived there was ill. In one he had found on the table in the room the coffins of three children in one family, all lying dead at one time. (Mr. Godwin produced a sketch of this room taken at the time.) In this case it had been as clearly ascertained that the children had died because of the stoppage of a drain under the house, as it could be proved that if you held your hand in the fire it would be burnt;—the relation of cause and effect was as clear and distinct as possible. In that

same family two other deaths had occurred before under similar circumstances, and it would be insulting common sense to say that if a man lived in a house where there was no ventilation, or if the air was injured by foul gases from the sewers, his health would not suffer; or that if a house were put down upon a swampy piece of ground, undrained and uncared for, the people occupying it would not suffer. He therefore must ask the meeting earnestly and sincerely to pay due regard to the exertions of those, whether of their own or of the medical profession, who were able to show that certain consequences must be the result of particular circumstances, and who urged them to correct those circumstances,—he asked them, instead of throwing obstacles, to cheer and help them on their way, for he felt convinced that an immense advantage must result from their labours.

Mr. Nash, Fellow, concurred in the observations of the Chairman. It was very gratifying to find gentlemen like Dr. Druitt, strangers to their own profession, willing to impart to them ideas which might not otherwise have occurred to them. He thought there was much to be learnt from Dr. Druitt's excellent paper, which did not appear to him to throw any imputation upon architects. It merely expounded a theory which, whether right or wrong, was worthy of attention. Architects did the best they could to make houses healthy, by means of proper drainage; and the system of laying permeable pipes below the footings, which Dr. Druitt advocated, was carried out in many, though not in all cases. The foul smells from the sewers could not be got rid of without some improved method of ventilating them.

Mr. J. W. Papworth, Fellow, agreed to a great extent with the views of Mr. Burnell and Mr. Haywood, but at the same time thought Dr. Druitt had done a public service by bringing the present question forward. The educated classes, as they were called, were in fact more ignorant of sanitary matters, in proportion to their opportunities of knowledge, than the poorer classes; and so far as his experience went he had found masters and mistresses more to blame than servants. In one of the best houses in the neighbourhood of the Institute, inhabited as it was by titled individuals, containing 30 bed-rooms, and dining 40 persons every day, there was only one closet in use, and that was in the yard. The doors of all the rest were rusted on their hinges and the keys were lost. Mr. Papworth referred to a case in which he had been engaged in adapting a large room for Sunday Services; but all his recommendations for improved ventilation were rejected by the promoter of the works, who was one of the leading philanthropists of the present day. So long as the old cesspools were in good condition he had never heard any complaint of them, either from medical men or others; but unfortunately they were generally out of order, by the neglect of the public themselves, and he could hardly remember a day when there was not an actual and almost a visible stench arising from them. The progress of science had turned the Thames into the largest sewer that ever existed, and now they wanted to know what to do with it. After a few more remarks in illustration of the great uncertainty which prevailed on sanitary questions, and the importance of collecting as much information as possible, Mr. Papworth concluded by moving a vote of thanks to Dr. Druitt.

Mr. Ferrey, Fellow, seconded the motion, which was carried uuanimously.

Dr. Druitt in reply, observed that they were really dealing with a question of human life or death, which of all earthly considerations was most valuable; and it was most important that they should not allow any bigoted adherence to professional etiquette, or any feeling of party warfare, to influence their views. It was true he had not specifically alluded to the want of food as a cause of disease, but he was very far from ignoring it, and had dwelt upon its equivalents in the form of want of clothing and mental anxiety, which deprived the body of its heat and the brain of its vigour as completely as want of food affected the system.

The Meeting then adjourned.

REMARKS UPON THE HISTORICAL REFERENCES TO BUILDING AND ART IN THE EARLIER WRITINGS OF THE OLD TESTAMENT.

By Robert Kerr, Fellow. Read at the Royal Institute of British Architects, March 5th, 1860.

Although three and twenty centuries have elapsed since the commencement of legitimate history under the Greeks, it need scarcely be remarked that beyond the threshold of this there lies a wide expanse of primitive antiquity, imposing in the extreme, not merely by reason of its still undefinable extent and still mysterious traditions, but on account of the actual remains of its handiwork, prodigious ruins and vast heaps of wreck which still fascinate the eye of the traveller in dreamy wastes and solitary places, once the streets of great cities and the courts of venerable temples.

In our own day, the patient toil of philosophical research has reduced the history of Egypt and Assyria, once but the material of romance, to the subject of a science; yet this question still remains, —how to obtain for its elucidation the equivalent of written record.

It may be said that all hope has been abandoned of discovering among the Egyptian and Assyrian remains anything like professed historical narrative. But this, I think, makes it only the more interesting to turn to one written relic extant, which is not only held to be a genuine product of the primitive ages, but which, as such, and so far as it goes, is even legitimately historical in its character, —namely, the Sacred Writings of the Jews. And what is most remarkable is this, that although more immediately bearing upon a single people, comparatively of humble influence, and essentially of peculiar stamp, yet this record connects itself, more or less circumstantially, but definitely and at certain well understood epochs, with every one in succession of the prominent powers of the traditional world,—Chaldæa, Egypt, Assyria, Babylonia, Phœnicia, and even Persia,—in short, with all that rises to the rank of historical nationality from the infancy of society to the time of Herodotus himself,

In such circumstances it may surely be said that, whatever the completeness of the evidence to be deduced from the remains, and upon whatever question, an ultimate appeal to these writings for confirmation, circumstantial and indirect if no more, may be expected to be, not only interesting, but of material service.

With such a view, and as an experiment, it may interest those who have been accustomed to search the path of primitive art to follow an attempt (although a hesitating one, for the ground is difficult) to discover what traces, if any, are to be found in the most venerable of records as footprints of Imagination's first advances to the Beautiful when the world was young.

Confining our present inquiry to the period of time antecedent to the conquest of Canaan by the Israelites, in connection with this the portion of the Sacred Writings under review will be chiefly the Pentateuch.

That the development of Fine-Art in so early a stage of intellectual progress was essentially bound up with the development of Building will be readily admitted; so that the association of these two subjects of enquiry, far from being inconvenient in respect of either, becomes matter of necessity for both.

The Historical Value of the Record.—As will presently be seen, the very first references to building in the Book of Genesis are so singular in their nature as to provoke the mind at the outset to enquire whether there are any peculiar influences of an historical kind under which the record appears to have been written.

Without enlarging upon the alleged responsibility of the prophet Ezra for the present form and

acceptation of the writings in question, and the remarkable fact in connexion therewith, that the time of Ezra (B.C. 450) coincides with that of the initiation of historical literature in the West, under Herodotus, I may say that I can see no reason in what I have read on this subject for considering the genuine primitive character of what we call Mosaic history to be at all impugned. Whatever may be the facts, known or unknown, of Ezra's translation, transcription, collation, or whatever else,* I think the historical enquirer, for all possible practical purposes, may safely take the actual material of the patriarchal narrative to have descended directly (in conjunction with the "Law" which formed the very basis of Jewish nationality) from the great lawgiver himself, if not perhaps in the very words, certainly in the same statements.

But at the same time it must be borne in mind, if we would arrive at reliable conclusions, that if there be any reasonable suspicion amongst Biblical critics to the effect that the statements of Moses, 1000 years after their promulgation, were modified, even in respect of language alone, this follows: whatever accuracy may be retained in all vital matter, the probability becomes great that in mere incidental and insignificant allusions the precise idea of the author may have suffered loss; so that, especially after the further lapse of 2300 years, it would be vain, even for the most learned Oriental scholars, to pretend to rely in matters of detail upon the mere turn of phraseology. Therefore, in such a subject as that at present in hand, where no desire could possibly animate the mind of either the author or the translator to be precise and technical, if accuracy of interpretation is to be attempted at all, it seems fair to say that it must be founded, not upon any individual statement, but upon a wide embrace of context and general scope.

CHALDÆAN TRADITION.—Looking at the practical purpose of the genealogical history of Genesis as being to convey to the Israelitish nation an account of its origin, this leads to the consideration of a most important element in primitive history, namely, that from the earliest distinguishable times there existed, as between Egypt on one hand and Western Asia on the other, a normal moral contrast, and even antagonism, which divided the small and simple family of nations between two great types of both faith and civilization. That the immediate result would be the appearance of two corresponding types of tradition is manifest. The Egyptian type we have in Herodotus, Manetho, and the remains; and whatever chronicle of ancient days came to Moses and his brethren from Abraham the Chaldæan may fairly be suggested to present itself none the less decidedly in Chaldæan form. Accordingly it is the fact that throughout the patriarchal genealogies, not only is the unquestionable prominence of the Egyptians in the primitive world overlooked, but the very existence of such a people is ignored. All the Asiatic tribes are accounted for in detail; but at the Desert of Sinai the world, to a Chaldæan, ceases to be. Even although Abraham, the founder of the Israelitish tribe, is recorded to have gone down into Egypt, and his adventures related,—although Moses himself, the writer, was Egyptian born and bred,—yet still the very existence of the great nation of the time is refused admission into the venerable story of the origin of mankind; and it is only at a much later time, as I think, that it is attempted, almost for figurative purposes, to include the Egyptians with their Ethiopian neighbours among the descendants of the accursed patriarch Ham.

The conclusion to be derived from this argument, if correct, constitutes one step more towards an adequate estimate of the value of any early Scripture references to the subject in hand, inasmuch as no allusion whatever can be expected to be found which shall bear directly upon the important question of Egyptian art prior to the time of the Exodus; for any such notice would necessarily be an interpolation on the part of the historian, whose proper attention is exclusively confined to Asiatic incident.

* Ezra led the Jews home from the Babylonish captivity, collected and revised the forgotten "Law," and transformed its records from ancient to then modern language.

Pastoral Tradition.—Not only was there a primary antagonism between Asia and Egypt but it is evidenced on all hands, and seems to be particularly so by the Sacred History itself, that there existed a secondary opposition between the pastoral mind at large and the civil,—between the ideas of the nomadic shepherds, dwellers in tents, and those of the settled agriculturists, dwellers in so-called cities. Therefore, as the children of Abraham, even in Egyptian bondage, in their triumphant exodus, in their transitional career in the Arabian Desert, in their invasion of Canaan, and in fact throughout many ages after their settlement there, were a people essentially of pastoral associations, it ought to be no matter of surprise if their history of the patriarchal ages should appear to be not only of Chaldæan type, but of peculiarly pastoral type. In other words, the builders of cities, for example, may very reasonably be expected to appear to disadvantage.

The builder of the first city, accordingly, is—*Cain;* and throughout the chronicle of Genesis, the curse of God and the building of cities may be said to appear as cause and effect. A startling principle like this demands careful investigation.

The contrast between the first born of Adam—a tiller of the ground under the curse, and the second—a keeper of sheep, is readily perceived; the husbandman rejected of Heaven, the shepherd accepted; the husbandman slaying the shepherd, and becoming doubly accursed. When Cain wanders forth a fugitive and a vagabond, his first prominent act thereafter is to build a city. His descendants it is, moreover, that originate the Arts and Sciences, in further progress into pernicious civilization; while the sons of Seth only "call themselves by the name of Jehovah," they are simple worshippers and nothing more. The descendants of Cain then bring ruin upon those of Seth,—the agriculturists upon the shepherds; the sons of God are beguiled by the daughters of men,—the men of the pastoral tribes by the women of the cities; and the intermingling of the races occasions the Deluge of destruction.

After the Flood, the course of city-building is the same. From Shem, the father of shepherds, the genealogy of the favoured race runs smoothly forward to the call of righteous Abraham and the development of spiritual monotheism; not a single city is founded. But the sons of Ham, cursed afresh, are city-builders from the first,—Nimrod of Babylon, Asshur of Nineveh, Sidon of Phœnicia, and so on, till there come the confusion of Babel, the burning of Sodom, and the spread of idolatry over the whole earth.

It need be no disparagement of its essential truth to suggest that this is history of a pastoral type; on the contrary, hard measure as it seems to render to the originators of Building and Art, we have perhaps but another evidence of its truth in its accordance with the verdict of all experience from that day to the present,—that God made the country and man the town.

The Ark of Noah.—The first attempt at description of building is contained in the account of the Ark. It is to be expected that this would be vague in the extreme; but it is sufficiently intelligible to be understood as presenting the idea of a timber house of the period, of vast dimensions to correspond to the tradition to which it belongs, and built free to float. The "*atsi gopher*" of which it is constructed is rendered in the Septuagint as *squared timbers*, in the Vulgate as *planed wood*, and somewhere else as *pitched wood;* our translation, *gopher wood*, as a technical term of material, seems to be without foundation, and the word never appears again in Scripture. It is a proof of the genuine primitive character of the narrative that no attempt is made to describe the Ark as a vessel for sailing: navigation being then unknown.

Primitive Cities.—The line of the reprobated Ham very soon produces Nimrod, not specifically execrated in the Record, but sufficiently so in extraneous legend, as the first mighty one and conqueror,—the first great public thief. I fancy him to be some bold spirit from the mountains of Media, who brings down a band of adventurers upon the peaceful cultivators, subdues Babel, Erech,

Accad, and Calneh, in the land of Shinar, all these being intelligibly placed as cities of Babylonia, and thus forms what is portentously called "the beginning of his kingdom," in allusion to the primitive form of empire,—the felonious subjugation of city after city for tribute without return.

Out of this Babylonian empire goes forth Asshur and builds, not conquers, Nineveh, Rehoboth, Calah, and Resen, in the plain of the Tigris. The list of these settlements is concluded with the remark, "the same is a great city." This, I think, by the construction of the sentence, applies to Nineveh; or, looking at the marginal correction in our Bibles, I can imagine the possibility of all the four names referring to Nineveh alone and its suburbs, or to a cluster of settlements which became afterwards combined. The intention of the writer is to identify the city in question with one which was of great importance at the time he was writing. Now received chronology, although it assigns a high antiquity to Babylon, does not accept Nineveh until B.C. 1273, about two centuries after the received date for the Exodus. But if the views of Mr. Fergusson be right, following, as he thinks, Manetho and the Rabbins, that the date of the Exodus is B.C. 1312, this passage might go to assist him, taking it as if Moses, writing just before his death, or Joshua afterwards, in making incidental reference to Nineveh, had appended the very natural observation, that this ancient city had now acquired great celebrity.

It will be convenient now to discuss what is meant by a *City* in the writings under our notice. It is clear that the immense plains of Western Asia, and sometimes also the more mountainous land, were occupied throughout the primitive ages by an almost inconceivable number of the settlements to which this term is applied, each under its own chief, or king. Some were evidently very insignificant; for the city of Shechem was sacked by a force of two men.* Others were of considerable magnitude, as Ai, where Joshua slew 12,000 inhabitants; and Gideon, not far off, which was larger still. But of their more general importance we may judge by the defeat of four kings, the conquerors of five, by Abraham, a mere nomadic chief, the leader of 318 men; also by the description of the territory allotted to Judah in the conquered Canaan, where we find 112 cities "and their villages" severally grouped within about 160 square miles; leaving room besides for several outlying districts, which are registered by name with "their towns and villages," so that there must have been at that spot, on an average, about one city and its villages to every square mile, over a considerable country.

The only explanation seems to be, that the term *city* is used to represent the enclosed settlement of houses of any agricultural family or tribe, large or small, as distinguished from the encampment of tents of a pastoral community. Some are spoken of as *great cities*, referring to magnitude; some are *fenced* cities, and *walled cities*, enclosed, the one class, perhaps, by strong fortifications, the other by defences less elaborate and complete; while *suburbs* and *villages* are described as the dependencies of the cities. *Towns* are also mentioned, as if belonging to outlying land. *Treasure cities* are spoken of as built by the Israelites in Egypt.

We are led to see the principle involved by looking at the present mode of life in various Eastern countries. The agricultural population reside in hamlets, going forth in the morning to labour in their several allotments of land round about, and returning at evening to their homes. Such hamlets are doubtless the cities of Scripture, the cultivated ground about being the *suburbs*, the *fields*, the *land*, the *vineyards*, and so on; and the *villages*, so called, being, I imagine, the buildings erected thereon as establishments for the day's duties, acquiring the name here given more properly perhaps when they increased in size and importance by reason of advancement in the manufacture of commodities of primitive luxury from the produce of the soil.

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* I cannot read the passage here referred to (Gen. xxxiv.) in any other sense than that the "city" was literally subdued thus: "two of the sons of Jacob, Simeon and Levi, took *each man his sword* and came upon the city boldly and slew all the males" (previously invalided by artifice).

The circuit of a primitive fenced city seems to have been of considerable extent, compared with our ideas of the requirements of residence; provision being thus made, not only for the storage of grain and general property, and the accommodation of cattle, but for the support of the population in time of siege from the produce of the land within the walls. The fortification itself was also of a magnitude to correspond; generally consisting of a large ditch, filled with water if possible, and a wall within formed of the excavated earth made into sun-dried brick; or an enclosure of rude stonework, where such was to be had; or sometimes a mere bank made of the soil as dug out. I need scarcely say that the height of the wall was the only real element of defence; and that thus there must have been a spirited competition between the heightening of walls and the lengthening of ladders. The gates of the city were formed of wood, covered with metal to protect them from fire; sometimes they were of metal entirely; they turned on top and bottom pivots. Occasionally the gates were even of stone, with pivots formed in the solid. The fastenings were clumsy bars of wood or metal.

Although a large proportion of the primitive cities must have been of trifling strength, there is every appearance of fortification having been the rule as matter of necessity,—the principle, in fact, of the balance of power of that day. But the account we read of patriarchal adventures does not give us the idea of a pugnacious population, far less of any practices of private or public plunder, except in rare instances. When the Israelites went into Canaan, they found the entire population in arms, it is true; but it was to repel invasion; and when, *à propos* of their having taken a certain king, and mutilated him, it is related that he himself had previously kept seventy kings, gleaning scraps under his table, similarly mutilated (their thumbs and great toes cut off), yet this is an exceptional case, and the rule of life amongst the cities appears to have been peace.

The only exception to this state of things would be an occasional desire on the part of some adventurous chieftain to acquire glory. This was carried out, however, in a peculiar way. No great geographical states were formed, even to the time of Cyrus, and no national revenues flowed from a large circuit to a centre of government; the conqueror subdued city after city, not to make himself their king in any modern sense, even by deputy, but to put them under tribute; and even this not so much for the luxury of power abroad as for the gratification of avarice at home. Majesty was not that of an empty purse and a page in history, but that of a luxurious palace and a very strong city; not the glory of a prosperous and powerful empire, but the tinsel of a peacock throne behind a high wall.

Babylon the Great was the acme of this phase of civilization. Its kings conquered the greatest number of cities, collected the largest revenues of tribute, and constructed the most prodigious enclosure of defence. Everybody knows the statement of Herodotus, that the city was some 15 miles square, and surrounded by a wall 300 feet high and 75 feet thick. Although these dimensions appear utterly incredible, a recent explorer* professes to verify at least the extent of circuit, and in fact to exhibit a double wall. It occurs to me, that if it were possible to suppose a third or even fourth interior subdivision, the credibility of Herodotus's statement would be increased. The smallest enclosure may have had its lofty wall, and the others fortifications of more comprehensible bulk; and if we consider the ultimate city to have been thus formed by successive extensions, and by means of those great masses of forced labourers which we know were employed in such works at the time, it seems to me that the limit of belief is not to be fixed by our own ideas of extent of circuit or bulk of section but by our computations of time and labour. No material had to be brought to the site; a vast trench was dug, the clay was dried into crude brick, and a vast wall was piled up, all on the spot. No skilled labour was required, not even machinery, but patient toil, with spade and basket; and a great mass of labourers would of course produce a great mass of work. We read that Solomon

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* M. Oppert. See his plan in Rawlinson's "Herodotus."

had 163,000 men at work upon his temple, and other known cases of the kind support the probability of this being so; 360,000 men, I think, were employed on Nineveh; 100,000 men for thirty years upon the Pyramid of Shufu and its Causeway (this we can prove to be reasonable); the entire people of the Israelites were employed in a mass upon their task-work in Egypt. If we suppose women to have formed in any case part of these numbers, labouring as they do in the East universally at this day, the marvellous is a good deal reduced. Grant me half a million of people established along the 60 miles wall, and even at the 300 feet high of Herodotus, it becomes a thing to be accomplished. But if we suppose the outer circuit, or even a double circuit, to be of moderate section, and only some small inner fortress of the greater height, and the several parts built at separate times, I see no reason why we should hesitate to accept the estimate of the Greek historian, as somewhat undiscriminating, but no worse. The rule whereby to test the marvellous in ancient history is to deny science, admit organization, and grant any amount of massed labour at any expense of human suffering and waste of human life.*

Babel.—In the land of Shinar, where Nimrod had made his kingdom, there stood three thousand years ago, I will say, as perhaps there stands there still, a certain mound of wreck upon the plain. The wandering family of herdsmen, passing slowly by with their flocks, would gather before it, at a safe distance, to recount to the youth of the tribe the legend of its rise and fall. The citizens of neighbouring hamlets, coming upon it every day, would never fail to take from their bosoms some talisman for protection against the genius of the accursed hill. Strange sounds were heard to haunt it, doubtless; and visions of evil spirits of another world, and evil men of this, were seen about it in the dark; for here was the great *City of Confusion*, the wonder of the world of that day. Abraham the shepherd chief and Isaac his son talked about it; so did Isaac and Jacob, Jacob and his sons; and in the land of Egypt, and in the house of bondage, the story was recounted after the day's task was done and the tale of bricks delivered under the lash. The wicked city-builders had met a downfall where that mound stood. They had begun to build at length so great a City and a Tower, that Heaven had come down to look at it, and had scattered the builders to the four quarters of the earth, never to meet again.

What would be the most likely fate of the first colossal effort in building? To theologians and even historians this may be doubtful; to us, as builders, not at all so. We know what bricks and mortar are, and how much more easily the vaulting ambition of the brain builds castles in the air than the skill of the ten fingers can realize them on the ground. The traditions say that the builder of Babel was Nimrod the wicked hunter; his impious arrogance, making war with God, raised only a ruin for his monument, which every child upon the mother's knee should hear of for thousands of years.

The *Tower*, which forms the most prominent part of perhaps every one's conception of this great work of impiety, was beyond doubt one of those edifices for worship which are called *High places* throughout the Scripture. The restoration which is now acknowledged of the Temple of the Seven Spheres at Borsippa, the ruinous mound called the Birs Nimroud, is one of these. The principle of design was to construct as it were an artificial hill and upon the summit to place the altar of a worship which, based upon a reference to the heavenly bodies, sought in a manner to attain a nearer approach to the divine influence by the simple expedient of elevation in the air. Every Chaldean city is considered to have had one of these High places or more. In this sense the expression used in the narrative "let us build us a city and a tower whose top may reach unto heaven" may perhaps refer, not to the ostentatious purpose of magnitude, but to the principle of worship involved. It is

* Calculation will show that the outer circumvallation of 60 miles circuit might have been constructed of moderate bulk by half a million of labourers in five years; the inner wall on a separate occasion in a similar time, and so on.

worth remarking that the Birs Nimroud is the mound which until lately was always looked upon as Babel itself, the Regal tower of Nimrod, and that under this impression its height was variously estimated accord to the religious zeal of the observer at from 200 yards (its actual height being not 200 feet) to 12 miles. St. Jerome puts it modestly at four miles upon the evidence of persons who had estimated it upon the spot.

One singular circumstance connected with the scriptural account of the Babel building is the use of the expression "they had brick for stone, and slime (bitumen) had they for mortar." This is strictly true to the primitive custom of the Babylonian region; but the phraseology would make it appear as if the record had been written by a person to whom stone was the only accustomed material. This could not be either Moses, a native of the Delta of Egypt, or Ezra a native of the city of Babylon; but a writer of purely Judæan associations might adopt such a mode of expression. Otherwise, there is this to be said. As I gather, the true reading is "to them a brick was for a stone and *chamar* for *chemar*"—the latter being the clay mortar of common use in the country, and the other the bitumen mortar of the great works. Perhaps the interpretation may be no more than this, —their bricks were like stones (not sun dried but burnt) and their mortar was bitumen, not clay,—so that their work might endure for ever,—so much the more the ruin.

The Period of Abraham and Jacob.—In glancing at the next point in historical sequence, namely the period of Abraham, we observe a good many allusions to the existence of cities such as we have lately had under consideration. When Abraham and Lot separate, both being nomadic chiefs, one takes the *land* of Canaan and the other goes "among the *cities* of the plain." In other words Abraham goes to the hilly country, which is devoid of these agricultural settlements, and Lot to the flat country, which is to a certain extent occupied by them. The extent of this occupation, however, at this time, may be seen by the fact that instead of the herds of Lot being incommoded by the appropriation of the soil, this tract of country is preferred by him to the other.

When we find Abraham with 318 men routing the army of four confederated kings, who had previously defeated other five, this seems a fair illustration of the existing state of society; but we are scarcely prepared to receive without astonishment the pretty well authenticated fact that these petty rulers were the then great powers of the Babylonian plain. If however Nimrod's Babel had been overthrown as we suppose, and his monarchy dissipated into a myth, it is easy to conclude that the whole region had been ever since in the less dignified occupation of the small scattered communities proper to the time,—the materials of the subsequent empire of history.

But with Abraham we come upon a new phase of our enquiry. The shepherd builds no City, but he erects a monumental Altar, plants a Grove, and buries his dead in a Sepulchre. His altar is of course but a pile of random stones, his grove is a single tree for a sacred shelter, and his sepulchre is but a natural cavern; but it is thus that the Temple and the Tomb have their origin; and the temple and the tomb have always monopolised the grandest efforts of monumental art.

Isaac also builds the altar. With Jacob we are introduced to the setting up of a stone for a pillar. Oil is poured upon it and the name of Beth-El—God's house—is conferred upon it, because it stands on holy ground. Jacob moreover, with his kinsman Laban, sets up a stone again and makes a *heap*, to mark the scene of an important compact. The Heap, however, is chiefly found, and in almost all countries, as the solemn shelter of the grave.

In after ages the setting up of a *Stone* such as has been alluded to became also a memorial of the dead. Jacob himself, being unable to carry the remains of Rachel to the sepulchre of his fathers at Machpelah, set up a pillar on her grave. It became a great land mark and stood for centuries.

The *Grove* also became an all important ordinance in the religion of the future, and continues to remain so in the East at this day.

The *Altar* gave rise to the temple; and the wealth of conquest and the labour of skill have never been grudged in thus honouring the Divine.

Even the *Sepulchre* in the field of the children of Heth is the type of marvellous works in Egypt and the far East.

But it is the unpretending *Heap* which outbids them all for the fame of eternity. The pyramids of Memphis are examples of the Heap; and as such there is a solemn grandeur in them which will never be equalled. Man's life is as the grass, and he is gone. It is so; but who can look upon that mountain of masonry, higher than the hills about it, and more enduring than the rocks, and reflect that its only purpose is to canopy the pillow of one little man, without astonishment at the stupendous magnitude of the conception? This man's colossal self-appreciation has piled up more solid stone over his own head than ever the greatest of the nations has offered, in one gift, all through the ages, to the Deity! Why, one hundred thousand human lives, from the cradle to the grave, have been created for the building of this man's tomb! The cost of toil spent upon it is as if a man, as good a man as he, perhaps a better, had laboured at the work for thirty thousand centuries! One little solitary man,—his body gone to dust, his coffin rifled long ago, his name—the very sound of it matter of debated science, yet there he stands in his identity after 4000 years perhaps, (for even time has lost its reckoning,) and there he means to stand for 4000 years to come unless the Earth should stop in its career.

Teraphim: The Rise of Art.—The theft of Laban's images, at this stage of our enquiry, suggests interesting matter for discussion; and with more direct bearing upon Art than may be thought. It seems perfectly clear from the Scripture history, and scientific enquiry bears out the fact, that the worship of the Divine Being as the One God, however simple to our minds, to the mind of primitive mankind is an idea that may be called exceedingly complicated. The uneducated intellect sees only multifariousness everywhere. The synthetical process by which this complexity is reducible to unity of arrangement and purpose is found to be, not an act of intuition, a self evident thing to the meanest capacity, as too many think, but on the contrary a matter of impossibility to the untrained judgment. Not only so, but the worship of the unseen divine influences by the help of symbols is in reality, however objectionable, the simplest means of adoration possible, instead of being, as we are apt to say, complicated and absurd. And accordingly when Abraham is found to separate himself from the whole world upon these two questions of monotheism and spiritual worship, not only the heroism but the intellect involved is prodigious. And so also when Jacob's young wife came to leave her father's house, and found it very hard indeed to part from the penates of the household, we must not wonder at it. In fact I should very much like to argue that the theft was not a private act of good Laban's pet child at all, but rather the act of the entire hareem of the departing son-in-law, Rachel the beloved being simply selected as the most efficient instrument for the obtainment at great personal risk of an invaluable public benefit. However, in a very early passage of human history, there the images are; and the value which is put upon them is clearly illustrated.

I have long held the opinion that the making of teraphim such as these was the very first exhibition of delineative Art on the part of man; so much so, that amongst a people of the earliest form of primitive intelligence (as the Israelites were) every image of the sort without distinction was considered to be an object of veneration. I think the entire scope of the Mosaic law in reference to the second commandment, frequently reiterated as it is, and the spirit of all the illustrations of that scope in the history of the Israelites, go to support this view. The Rabbins to this present day maintain that the second commandment forbids *in limine* the possession of any image; and the Jews, (so I read) as a general rule, admit no statuary into their houses. This of itself is pretty clear evidence that when the Law said "Thou shalt not *make* unto thee any graven image or any likeness," "Cursed

be the man that *maketh* any graven or molten image," and so on,—frequently repeating the principle in a variety of language,—the object was to avoid the universal tendency to symbol-worship by the absolute prohibition of symbol-manufacture. If this was indeed the law, the practice which it struck at must have been very deeply rooted; and if it was indeed so universal as I have described it, we must admit that nothing less sweeping than this form of prohibition could have reached so grave an evil. Accordingly Josephus leads us to believe that even the cherubim were of no *likeness*, (perhaps the winged circle of the Assyrians, and not the winged human figure of the Egyptians,) and broadly states that King Solomon in the sculptured decorations of the Temple infringed the law; "he fell into an error" says the historian "about the observation of the laws, when he made the images of brazen oxen that supported the brazen sea and the images of lions about his own throne; for these he made, although it was not agreeable to piety so to do." In fact the very altar, as you will remember, was directed to be made of unhewn stone lest even the handicraft of the mason should take the object out of the category of real life; "if thou lift up thy tool upon it thou hast polluted it." The always backward state of the Jews in Art would be the natural consequence of a policy of such a kind.

The result of this view of the question, if correct, would be this, that as we may be said to allow the fact on every hand that idolatry was the chief or even sole support of primitive Art, so much was this the case that the prohibition of idolatry involved even the prohibition of Art, as a matter, not of mere expediency, but of necessity.

The Teraphim of early days were like the Penates of the Romans; and in the form of symbolical figures of the elements and principles of nature, and of the imaginary genii of times and places, they seem to have become so numerous that we may say without a jest that the discovery and invention of new gods was the recreation of those who considered themselves in advance of their age.

Amulets, again, or magical trinkets, which would in fact be the earlier form of teraphim, continued to be much used in the times we speak of; and, some eight years after the adventure of the theft of Laban's gods, we find Jacob demanding from his family the delivery of all their images "and their earrings" that he might cleanse his household from idolatry in the hope of securing divine alliance against the friends of the Shechemites whom his sons had slain. It is to be remarked also that the *destruction* of idols, afterwards the most prominent of all principles in Jewish duty, was not yet introduced; the patriarch merely buried the obnoxious objects in the ground, choosing moreover a sacred place ("under the oak") as if so to treat the strange gods with respect although compelled to part company with them by the necessities of the moment.

The Exodus.—After the time of Jacob nothing attracts our attention particularly until we come to Moses himself. Here we are on new ground. Tradition of the past (so to call it) is concluded; history by an eye witness begins; if the narrative now be anything equivalent to what we are accustomed to think it—the work of Moses,—if it be even the work of his time, or indeed of any later time upon materials left by him, it seems manifest that we are entitled to expect a new precision of detail, which will admit of comparison with remains. And in further support of this idea, however strictly we examine the record of the Exodus, it seems impossible to imagine but that at least the basis for its descriptions must have come from the very day when the occurrences took place. In short, mixed up as the history now is with Egyptian transactions, and afterwards with the later Asiatic, it may surely be said that its indirect evidence, if no more, becomes an element of the utmost importance in the determination of that difficult problem, primitive chronology.

This question of Chronology has long been so closely identified with all study of primitive art that I cannot at present altogether avoid allusion to it. The point is whether, as regards evidence of the artistic class, the received theories and the Mosaic testimony do or do not concur.

The synchronous date for the Exodus at present preferred by explorers is that of the nineteenth dynasty in Egypt, corresponding with the præ-Assyrian age in Asia.

In the case of Asia I complain of nothing, but a strong desire which is always apparent in our authors to establish the existence of monarchy from Nimrod downwards, changing dynasties and seats of power, but always governing the whole land. This cannot be in accordance with either the patriarchal adventures already referred to, or the Israelitish progress now; and it seems singular that it should be so hard, in dealing with such remote antiquity, to dismiss from the mind the entirely modern idea of Empire—a geographical enclosure with centralized rule.

As for Egypt, however, I am inclined to question whether there may not be positive discrepancies between the Jewish records and the interpretation of the remains; in other words, although I pretend to little knowledge of the chronological theories except their conclusions, I cannot help thinking that the evidence of the Pentateuch has yet to be taken.

The period assigned as above mentioned for the Exodus gives us at that time the pyramids of Memphis 1000, some say 2000, years old; the Pharaohs ruling the whole valley, from Thebes, in the midst of all the magnificence now in ruin there; even the Karnac temple of Osirtasen a work of many centuries before; the expulsion of the Hyksos, after their oppressive rule of 500 years, a tradition as old as the date of Jacob; the power and glory of the 18th dynasty, Thothmes after Thothmes, Amenoph after Amenoph, past and gone, an age indeed of the very successors of the Pharaoh who was Joseph's friend; the prodigious conquests of Rameses all over Asia (so considered), and his triumphant return through the very fields of Goshen, a drama of yesterday!

What if there be in the pages of the Pentateuch *not one word* of all this?

It is not that the narration of the events of the Exodus as affecting this question, however general, is not elsewhere circumstantial; for note is even made that when the hail came the flax and barley were smitten, but the wheat and the rye were not sprung up; the description of the brick-making is perfect; the tabernacle in the desert is presented in full detail; previous tradition is even minute; and as for any suppression (as is sometimes alleged) of reference to idolatrous manners, there is no appearance of such an idea either here or elsewhere. The only suggestion which seems to me a philosophical one is that where there is no description there was nothing to describe. To put one's self in the position of the writer of the narrative is a thing that many a one in these days of Oriental knowledge can do. How then would such a one deal with the material supplied by the Egyptologists? Let his glance be ever so cursory at non-essential matter, I think it would be *impossible* for him to help alluding, for instance, to such as the following; to the pyramids, almost within view of Goshen, a perpetual source of horror to a subject race; to the great Memphis, its temples, and idols, abomination to the Lord; to the distant Thebes, and the pride and arrogance of Pharaoh there, surrounded by his images; to the journeying of Moses and Aaron for 300 miles to his court, and their conversation with the officers; to the painted walls, so hatefully enlarged upon by later writers; to such a thing as the sphinx, which by all scriptural analogy would have become a standing simile in the language,—an impious attempt to be equal with God,—a demon which the pen of Isaiah or Jeremiah would have figured as lying in wait to devour the whole land when the cup of its wickedness was full.

On the contrary, what we have is to all appearance the description of an entirely different condition of society. There is brickmaking of the very earliest type; there are two treasure cities,—fortified stores towards the Arabian desert to protect the contents from pillage; there is the daughter of the king, coming to the river side to wash herself, with her maidens, finding an infant among the bulrushes in a little ark of flags and making a son of him; when Moses and Aaron go to Pharaoh with their demands he meets them, not by the imposing presence of a high priest clothed in the

sacred leopard skin and wielding the power of Amun, but by the arts of wretched enchanters and the undignified resource of personal debate and even abject propitiation; when even the "gods of Egypt" appear in our translation, these *Elohim* are not the gods of worship but the chief men in a vague manner.

The evidence on the other side,—the late introduction of the horse in the monuments, as against the horses and chariots in the Red Sea,—the Expulsion of the lepers of Manetho,—the name of the city Raamses,—the abomination of the shepherds,—the conquest of Asia,—the capture of Khadesha on Karnac,—and such testimony from perhaps many another source,—I do not attempt to overlook; but here is a written chronicle of the very day, and I am afraid it is plain that its evidence has at least not yet been fully taken.

In thus suggesting the question whether the Exodus is not in fact an older event than the building of the Pyramids,—an event belonging to the days of a primitive monarchy at the Delta,—I do not at all object to the mere extent of duration ascribed to Egyptian civilization. But it must be manifest that if the date of the Exodus is computed upon the chronological system of the Jews, and the Chronology of Egypt from the remains, a correspondence of results is not to be expected. Is it possible to leave the Pyramids where they are in Chronology, and yet put the Exodus earlier? Might not the 40 years passed in the wilderness of Arabia merely be, as often occurs, *forty* in the sense of *a great many*,—perhaps centuries?

Again, an interesting question of art-history which time prevents me from taking up further than I have done, but which has an important bearing upon this, is the purpose of the second commandment. The distinction is ably drawn by commentators that the first commandment overthrows the worship of false gods in the ideal, but that the second applies to images alone in the real, and, as the Jews say, to the very making of them. It seems to me that the precise application of this regulation as matter of fact would be proof of a very close kind as to the state of society in Egypt at the time. Mr. Fergusson I think suggests that the prohibition was levelled against the use of hieroglyphics; I prefer to think it was against teraphim; it is possible that it may have been against statues—the very examples to be seen in our museums; a very close investigation might determine this and turn it to historical account.

Jewish Art.—A concluding word may be said upon the position attained to in respect of Art by the Jewish nation afterwards formed.

When the Israelites emerge from their nomadic life in Arabia and invade the land of Canaan their faith is immediately brought into collision with the idolatry of Western Asia. A long career is passed in transactions which turn, more closely than upon anything else, upon an alternate adoption and rejection of idol worship. There seems to be every reason for believing that the making or not of images was throughout the period, as regards this people, the great artistic question of the day. The consequence necessarily was the prevention of the very rise of any school of artistic endeavour; for sculpture is always the first step in Art. When at length a monarchy was established under David, the immediate effect was the desire for stately buildings for royal residence and sacred ceremonial; and under the celebrated poet-king and his still more famous son—husband even of Pharaoh's daughter, as native wealth increased and foreign tribute flowed into the treasury, the king's house of Cedar, Solomon's house, the House of the Forest of Lebanon, and the Temple of the great Jehovah, filled the minds of the people with an admiration and awe, the expression of which for ages afterwards in hyperbole and metaphor has misled the world till now as to their grandeur. They were but small works compared with the buildings of greater nations; and what is more, the merit of their design and execution was not native,—they were the works of Syrians. But even this glory of Jerusalem was of short duration. When David desired to build for God a beautiful house, he had forgotten the simpli-

city of worship which, surrounded as he was by idolatrous nations on every hand, was still the palladium of the faith,—the protestantism of the primitive world, of which Abraham was the more majestic Luther. When Solomon dedicated the carved work of Zion he kindled a spark of unconsecrated fire which before he himself was in the grave had crumbled all his glory into dust. "He died ingloriously" says Josephus. The wisest of men in his old age bowed the knee to Ashtaroth and built high places for Moloch. Before he had slept five years by the side of his father, his own son had broken his sceptre for ever, his people were worshiping "the Calves" even on Jacob's Beth-El, and Shishak of Egypt had polluted his temple of holiness, and taken away all its treasures. If our task were to examine the history of early Art in more detail, not the least instructive part of our review would be the work and the reward of Solomon as the Augustus of his time. In the peculiar atmosphere of that country and that day, this great man became but the sternest example in all history of the effect of refinement in the decay of power. It is a story often told; and at the present moment ourselves are only sustained by the hope that in a new experiment a new result will appear. May we not be disappointed in our expectation, that the time has at length commenced when our delight in the beautiful, instead of being the premonition of decay, shall go hand in hand with the Divine honour and the advance of manly virtue!

[The lecture was illustrated by drawings of the Pillar, the Altar, the Heap, the City, Teraphim, &c.]

Mr. Lockyer, Fellow, acknowledged the great talent, industry and research which Mr. Kerr's interesting paper had displayed. But he thought that Mr. Kerr was wrong in the views which he had taken. It must be evident that the five books of Moses were written with one sole purpose, —namely as a record to the Israelites of their origin and progress in the past, and as a body of law for their guidance in the future. Egypt was only mentioned in the Bible where it was impossible to avoid it, and every mention of Egypt appeared to be made with feelings of abhorrence. He could not see any point in the Books of Moses which would tend to refute the system of Egyptian chronology established by the researches of Lepsius and other writers. The date of the Exodus was a difficult question. The first chronological point at which Egypt came into contact with Israel was at the conquest of Jerusalem by Shishak, which was a fixed date, about 970 B.C. The Temple had then been built about 30 years. According to the Jewish records the time from the Exodus to the building of the Temple was 480 years,*—but on that point even the Sacred Writings differed.† This period however might be taken to be nearly correct, and in Egyptian chronology, the contemporaneous 20th and 21st dynasties of Manetho would occupy also a period of about 480 years, to the time immediately preceding the reign of the third Rameses, the last of the Egyptian conquerors, thus bringing the period of the Exodus to the reign of the immediate successor to that Rameses of the 19th dynasty, who, according to Josephus and other authorities, was father to an Amenophis and son of the great Sethos. He would endeavour to show that there was a complete correspondence between the chronology of Egypt and that of the Bible. First, then, was there anything in the tradition or the monuments of Egypt of that period to assist us further in fixing this as the date? It was not likely that a subject pregnant with disgrace to the Egyptians would be recorded upon their monuments. There was a straightforward account of the Exodus in the Books of Moses, and there

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* 1 Kings vi. 1

† The Septuagint version has 440 years, whilst in the Acts (xiii. 20) the period is stated to be 450 years to the time of Samuel only. The genealogies in the Book of Judges, on the other hand, would tend to reduce the number of years considerably. Lepsius, from a careful comparison of these genealogies, has come to the conclusion that the actual interval was about 360 years only; and in his chronological tables of the Egyptian kings, as corroborated by the monuments, compresses the reigns of the 20th and 21st dynasties into a like period. The whole subject is involved in great difficulty; but the genealogies must be considered as the most satisfactory proof of the correctness of his conclusions.

was nothing in the Egyptian monuments to dispute it; in fact Mr. Kerr's paper showed that there was much to corroborate it, and that the Egyptian version of the story is such as might be expected from a people trying to invent something to get themselves out of their difficulty. Josephus, quoting Manetho, says that for certain reasons this king Amenophis was advised to expel all the lepers from Egypt; these lepers were consequently collected together in the Sethroitic nome, which corresponded with the land of Goshen, and were condemned to hard labour in the stone-quarries East of the Nile. Here they elected for themselves a chieftain, who was a priest, (another point of close correspondence with Holy Writ), named Osarsiph. Josephus did not quote this as relating to the Exodus, as he believed it referred to the expulsion of the Hyksos; Diodorus narrated it in similar terms, saying that this High Priest who afterwards changed his name to Moses, made changes in religion, prohibited the worship of the Gods, and forbade the leprous tribes which accompanied him to eat the food of the Egyptians. There was every probability that this tradition had originated in the fact of the Exodus. The date of the latter is thus fixed to the reign of Menepthah,* who was represented on the monuments as the son and successor of the second Rameses and the father of the second Sethos. In the next place it is to be noted that the two princes who immediately preceded Menephthah were the great Rameses and his father Sethos I, the conquests of both of whom were represented in the sculptures at Karnac and Gourneh, from which it was evident that these monarchs must have overrun the whole of Western Asia from Pelusium as far as the Ægean and the Caspian Seas. Prisoners were represented who were evidently Asiatic tribes, in every variety of costume, and invariably as conquered enemies. Among the places recorded in the inscriptions as having been subdued was Canaan (Kanana in hieroglyphics). Canaan was represented by Mr. Kerr as a hilly country, but it is in reality "low lands," or plain along the sea coast. The high country was Mesopotamia, called in Scripture Aram Naharaim, "the high land of the two rivers," and in hieroglyphics "Naharaina;" and which, with the country of the Amorites (Amour) was also indicated as having been conquered. The Hittites (Khita) and the Syrians (Sharu) are represented in the sculptures.† Now if these countries were really conquered and overrun by Rameses and Sethos, it must have been before the Jews settled in the Holy Land, because the tribulations which the Jews endured from the Canaanites, Midianites, Moabites and others are specially recorded in the Book of Judges, and if the Egyptians had overrun that country it would undoubtedly have been recorded in Holy Writ also; but there is no mention of Egypt in the Scriptures from the period of the Exodus until Solomon, who married the daughter of a King of Egypt. The great conquests in Western Asia must therefore have occurred before the Exodus. Nor could it be objected that Rameses III, who reigned after the departure of the Israelites, was also a conqueror, because his reign fell within the period of the 40 years during which the Israelites were wandering in the desert. He reigned 19 years, and made some incursions into Asia. The epoch of the Exodus is corroborated also by another piece of indirect evidence to be deduced from the names of the cities built by the Israelites for Pharaoh, Pithom and Raamser. The name of Rameses did not occur before the 19th dynasty, and it is therefore improbable that it would have been applied to a city previous to its appearance as a dynastic name; but the "city of Raamses" is intelligible at once if we suppose it built in the lifetime of Rameses II. The name of the other city (Pi-Tum, the temple of Tum) connects it also with this monarch, who was found associated with the gods Ra and Tum at the ruins of Abou Keshêb, believed by Lepsius to be the site of Raamses.‡ These cities were intentionally built at the extreme points of the ancient Nile canal, which we are told was commenced

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* The Amenophis of Josephus, and Amenephthes of Africanus.

† See Wilkinson, "Manners and Customs of the Egyptians," first series.

‡ Engraved in Wilkinson, "Mat. Hierogliphica," Appendix 4.

by Sesostris,—hence the reason of their construction. Sir Gardner Wilkinson had engraved a portion of a tomb at Thebes illustrating the manufacture of bricks, and showing that it was carried on by captives. He had stated that his investigations left him little reason to doubt that the manufacture was a government monopoly. Every brick was stamped with the name either of the monarch in whose reign it was made, or of the factors who farmed the monopoly. The Jews were captives in Lower Egypt, and there was no reason to suppose that Moses had ever been at Thebes, a distance of 300 miles up the country. Another important fact was the scriptural assertion that the shepherds were "an abomination to the Egyptians;" a statement which could only be applicable after the expulsion of the Hyksos, or shepherd tribes, who, whilst the dominant power, had destroyed and ruined the Egyptian Temples. In earlier times the shepherds and husbandmen were not so contemned, the wealth of the Egyptians consisting in their flocks. It was a singular fact that the tomb of perhaps the first architect on record bore an inscription enumerating amongst his possessions 835 oxen, 220 cows, 2234 goats, 760 asses, and 974 rams. The name of this architect was Eimai.* He appeared to have held a position corresponding with that of the Mediæval "supervisor" referred to in Mr. Wyatt Papworth's recent paper; he had the regulation of the buildings erected in the reign of Khufu,† and might, probably, have been the architect of the Great Pyramid. Now neither in this tomb, nor in any other monument of that period, was there any representation of the horse, which it would seem the Hyksos, a Semitic race, introduced into Egypt at a later period. The mention of the horse, therefore, in the Scripture narrative again points to an epoch subsequent to the expulsion of these invaders by the 18th dynasty. On another point Mr. Kerr had made a great mistake. Oriental customs had seen very little change for centuries, and any reader of the "Arabian Nights" would perceive that there was a great admixture of classes, and a much easier access of persons in humble life to the Sovereign of the East than could take place in the West; a fact which should be borne in mind in considering the questions raised by Mr. Kerr. Mr. Lockyer, concluded by referring to the tombs of two other Egyptian architects. One of these lived in the time of Rameses III., and appeared to have designed and built the small palace of that monarch at Thebes, known as the Pavilion of Rameses III. The other was the designer and builder of the *Menephtheum* at Thebes, which had been an exceedingly fine building, and was still a most magnificent ruin.

Mr. Jennings, Fellow, considered that both the paper and the discussion had kept rather wide of the question of building. Mr. Kerr had described the Jewish cities as farm houses, and their villages as out buildings,—a matter which was somewhat architectural; and it was to be hoped that some gentleman present acquainted with oriental art would furnish some further information on the nominal subject before the meeting.

Mr. Fergusson, Fellow, said there had been so little architectural comment in what Mr. Kerr had said, that he should have little to observe upon it. That gentleman had represented in one of the drawings on the wall, the Birs Nimroud, which had been generally supposed to be the Tower of Babel. But there was really no connection to be traced between the two. The Tower of Babel was never built,—it was stopped at its very beginning; and there could be no doubt that the Birs Nimroud had been entirely built by Nebuchadnezzar, whose name was stamped on every brick, from the foundation to the top, as Sir Henry Rawlinson had proved. It had no connection with anything to be found in the Bible,—it was a Sabæan Temple dedicated to the worship of the spheres, and built in seven stories of different colours,—black, orange, red, yellow, green, blue, and the uppermost probably white. The other building described by Mr. Kerr as the heap, was undoubtedly a tumulus or sepulchral

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* Champollion. Lettres Écrites d'Egypte et de Nubie.

† The "Cheops" of Herodotus.

monument. These buildings were used as relic shrines, or recesses similar to the stone altars or shrines in Catholic churches. He could see no connection between them and the records of Holy Writ, and believed them to be of comparatively recent date. Mr. Kerr had referred to the Walls of Babylon, which were more connected with architecture;—but had adopted the greatly exaggerated statements of Herodotus and Diodorus. The assertions of those writers with reference to the extent of Nineveh had been proved by actual discovery to be erroneous; as the walls which had been excavated and clearly traced, could not have enclosed a city more than one tenth of the dimensions which they assigned to it. Mr. Kerr had taken out the quantities of the walls of Babylon on the data of these authorities, and appeared to believe in their accuracy; but the erection of a perpendicular mud wall as high as the dome of St. Paul's, surrounding a city to the extent of 60 miles and capable of resisting the rays of a tropical sun, was a task which certainly no modern architect would like to undertake, and a supposition which he thought perfectly ridiculous.

Mr. Ashpitel, Fellow, expressed his regret that Mr. Kerr had not dwelt more upon the architectural and artistic notices to be found in the Old Testament than on the historical points of the date of the Exodus. Much might be said on the subject of Solomon's Temple and the house of the Cedars of Lebanon;—the dimensions and materials of which were so fully described in those interesting chapters of the Holy Scriptures which had attracted the attention of the learned for so many years. He had been much startled by some of Mr. Kerr's observations, and particularly those on the labours of the prophet Ezra. The universal tradition was that the Books of the Pentateuch, in the original archaic Hebrew, had been preserved to the days of Ezra, and that all he did was to render them into the Chaldæan language. Mr. Ashpitel then referred to a small folio volume by Canina on the question of how far the art of the Hebrews might be traced to that of the Egyptians. Unlike the late Mr. Wilkins, Hakewill, and other writers of their school, Canina endeavoured to show that there was a close resemblance between the works of the Egyptians and the Jews, and had illustrated his views on this point by descriptions and plans.

Mr. A. J. B. Beresford Hope, Hon. Fellow, wished that Mr. Kerr had entered into a branch of architectural science of which only enough had lately been heard to make every one wish to hear more. He alluded to the discovery of the tents, houses, and actual cities of the Moabites and other ancient nations, by Mr. Cyril Graham, who had described them with so much ability, and with such force of conviction, that the only regret must be that the absence or neglect of architectural knowledge on the part of that gentleman had deprived the public of any drawings or architectural details of such interesting remains of antiquity. Mr. Kerr or any other gentleman who might establish the fact that these were really the cities of the Moabites, or (as they might be) were of much earlier date, and who might fully illustrate and describe them, would be the greatest possible benefactor to the archæologists of the present age. Mr. Kerr's view of the insignificance of the Jewish cities, and his literal reading of the text that one of them had been captured by two men, were certainly erroneous. The two men where no doubt the commanders in chief, and it would be equally correct to say that the Battle of Solferino had been won by two men, the Emperor of the French and Marshal Macmahon.

Mr. George Grove, Visitor, stated that the investigation which had been commenced by Mr. Cyril Graham had been carried on by Dr. J. G. Wetzstein, the Prussian Consul at Damascus, who had written elaborate papers on the subject, with fuller details than Mr. Graham had been able to give. These papers were entitled "Travels in Trachonitis and the Hauran mountains in the spring of 1858," and had appeared in a German magazine of Geography called "Zeitschrift der Allgemeine Erdkunde" (August—October, 1859). They were accompanied by wood engravings of the country visited, a plate of inscriptions, and a map of the districts by H. Kiepert.

Sir J. Gardner Wilkinson, Hon. Member, said that the chronology of Egypt, which had been enlarged upon by Mr. Lockyer, was in a very uncertain state; particularly with regard to the 18th and 19th dynasties, and it was therefore very difficult to say when such monuments as the Pyramids were built. But he had no doubt, they were of very great age, and much anterior to the Exodus. That the Pyramids were not mentioned in the Bible was no argument for their more recent origin, because, as Mr. Lockyer had well observed, it was not the object of the Sacred Historian to enter into the history or arts of the Egyptians. It was too much the custom to expect to find in the Bible references to astronomy, geology, and similar subjects; and it was not the object of Moses to speak of the Pyramids, the Sphinx, or other Egyptian works. In like manner it had been urged against the antiquity of the Pyramids that they were not mentioned by Homer, but this fact was no proof that they did not exist in his time. Even Herodotus, who had visited Egypt, scarcely mentioned Thebes. He said that he had been there and conversed with the Priests,—he spoke of the Labyrinth, but said nothing of the great temple of Karnak. At present the early chronology of Egypt was very uncertain, the only safe starting point being from the time of Shishak, which was comparatively late: and all that could be done was to wait until some astronomical calculation, such as that of the rising of the dog star, should lead to some approximate data. It was a remarkable fact that no representations of the horse were met with in Egypt before the 18th dynasty, and as the horse was mentioned in the Bible, the tombs not containing representations of that animal may safely be considered *previous* to the Exodus: therefore the Pyramids and the tombs in the vicinity were so. Mr. Kerr had suggested that the Pyramids were of later date than the Exodus, but on the contrary there was no doubt they were much older. Nothing was known of the architecture of the Jews beyond what could be gathered from the Bible and from Josephus. They worked and built for the Egyptians, and might be supposed to be skilled in the building arts. Their being forbidden by their religion to represent living creatures was not to be regarded as an impediment to their artistic skill, as might be argued from the ability displayed by the Arabs, who laboured under the same prohibition.

Mr. Papworth, Fellow, argued that there never had been any true Arab artists; and that the great works in the Byzantine style were the products of the natives of the countries in which they were respectively erected. The remarks that had been made shewed that the subject was in a state of great confusion, but Mr. Kerr's paper constituted an admirable introduction to what might be a most interesting and romantic work, on the history of the civilization of the world as represented in the building art. He begged to propose a vote of thanks to that gentleman.

The Chairman concurred in the importance of Mr. Kerr's remarks, which being limited to the *earlier* writings of the Old Testament, could not of course be expected to embrace matters of bricks and mortar of a more practical kind than those he had referred to.

The motion was unanimously carried.

Mr. Kerr in acknowledgment observed that he considered all the remarks which had been made had tended to shew that the subject was almost entirely unopened; and that he must have had considerable boldness to enter upon it. He had done so to the best of his ability, and had felt the extreme difficulty of the subject,—having had more trouble in rejecting what he might have said upon it, than in saying what he had.

SYMBOLISM IN REFERENCE TO ART.

Read by Dr. Barlow, at the Royal Institute of British Architects, March 19th, 1860.

The earliest architecture with which we are acquainted is that of tombs and temples; and the earliest sculptures and paintings are found associated with them. Thus art, taking its origin from a sacred source, and having an especial reference to sacred things, partook of their representative character, and became essentially symbolical. Egyptian tombs and stelés exhibit religious symbols still in use among Christians. Similar forms with corresponding meaning, though under different names, are found among the Indians; and are seen on the monuments of the Assyrians, the Etruscans, and Greeks. The Hebrews borrowed much of their early religious symbolism from the Egyptians, their later from the Babylonians, and through them this symbolical imagery, both verbal and objective, has descended to ourselves. The early Christian architects, sculptors, and painters drank deep of symbolical lore, and reproduced it in their works.

It is not merely that certain natural objects, as the sun, the moon, luminous ether, fire, &c.; certain animals, as the lion, the ox, the eagle, the peacock, the dove, &c.; certain trees and plants, as the palm-tree, the oak, the sycamore-tree, the hom, the lotus, and the lily, play pretty much the same parts in all religious systems, in virtue of that established relation between mind and matter, which never changes; nor that in dogmatic theology certain conventional figures are put to signify certain specific things, and thus come to influence architecture and her sister arts; but that the very designs of sacred edifices—their forms, arrangements, and ornamentation,—all have their origin in a significant symbolism, and were conceived and carried out in accordance with it.

Emblems, *symbols*, *types*, all have this in common; they are the representatives of something else for which they stand. *Emblems* and *symbols* often differ only in their mode of application: thus the *palm-branch* is an *emblem* of Victory, but taken in a Christian sense it is a *symbol*, significant of the victory of our faith, and is given to all Christian martyrs who have thus overcome death. The *anchor* may be a mere emblem of hope, but when it is put for the hope of a Christian it becomes a symbol. So, also, the equilateral triangle may be nothing more than the emblem of three united in one; but as significant of the doctrine of the Trinity, it is a symbol of the highest order.

Types are different both from emblems and symbols, and have a sort of antecedent parallelism to the objects for which they stand: thus *Moses* is regarded as the type of *Christ;* the *manna* which fell in the wilderness, as the type of the *true bread of life* that came down from heaven; the *water from the rock* in the wilderness, as typical of the water of *life from* Christ, the living fountain; and so of other types. The earliest Christian sculptors and painters were very partial to the employment of types, but their successors seem to have preferred symbols.

It is difficult in a few words to give an adequate definition of the meaning of the word *symbolism* that shall comprise the use of symbols, symbolical treatment, and the application of symbolical principles in design; perhaps it may be called an outward expression in art of an inward sense, meaning, and purpose. The first of the series of drawings to illustrate the history of Christian sculpture, up to the time of Nicolo Pisano, is taken from the very interesting early Christian urn in the Campo Santo, at Pisa, described by Ciampini. Many types are here introduced: there is the sacrifice of Abraham, the passage of the Red Sea, Moses striking the rock, the gathering manna in the wilderness, Daniel between the lions, and other subjects. In the second we have the Saviour within an ornamental oval frame between the symbols of the four Evangelists. It is in the Campo

Santo, at Pisa. In the third, a drawing of the famous urn of the Baptist in his chapel in the cathedral church of Genoa, we have subject and symbolism mixed up together, as was the constant practice of sculptors at that period, about the eleventh century. This urn is of Byzantine, or rather Alexandrine work. I call this style *Greco-Christiano*, in contradistinction to the style of the first of this series, which is *Romano-Christiano*. We cannot fail to recognize Roman and even Etruscan motives in this, while Greek motives are evident in the other. There is the head of Jupiter, within the equilateral triangle, between two lions, &c. In the fourth we have a very symbolical nativity, from the bronze door of the Duomo at Pisa, date A.D. 1206. The fifth is a nativity nearer to the time of Nicola Pisano. It is from the Duomo at Siena, and much might be said about it.

Many of the subjects of Christian art, as the Nativity, the Baptism, the Miracles, the Crucifixion, would appear to have been originally almost entirely symbolical; they next became conventional, and lastly pictorial, in the ordinary sense of the word, losing almost entirely their religious character. This was especially the case with the most frequent representation in religious life—the Virgin and Child,—which at first was a symbol only, introduced after the condemnation of the Nestorians at the council of Ephesus, A.D. 431, as an evidence of holding the orthodox faith. (See "Legends of the Madonna," p. 22.) The dogma of the Mother of God was of Egyptian origin; it was brought in, along with the worship of the Madonna, by Cyril and his monks of Alexandria, in the fifth century. The earliest representations of the Madonna and Child have quite a *Greco-Egyptian* character, and there can be little doubt that Isis nursing Horus was the origin of them all. The Chinese also recognize this old pagan notion in *Tien-how*, the Queen of Heaven, nursing her infant Son, who is usually represented holding a lotus-bud as the symbol of the new birth. The pictures of the Madonna and Child, commonly called Byzantine, I have long thought would be more correctly named *Alexandrine*. At Alexandria there was an established school for their production from an early period. The very colour of the flesh in these holy pictures is sufficient to establish their maternity: the Madonna, if not "comely," is at least nearly "black."

The sexual principle which rules the animal kingdom, and was long suspected to rule the vegetable kingdom also, before the fact was shown, came to be symbolically set forth as the foundation of a religious creed; but in a conventional way, that divested it of any indecency.

One form, and that the most prevalent, by which the sexual origin of all things was indicated, was *the equilateral triangle*. M. Guigniaut, in his "Religions of Antiquity," a translation, with additions, from Creuzer's "Symbolik," has the following passage from the popular myths of the Hindus: "Sur la montagne d'or, Cailasa, habite le dieu Siva. Là est une plateforme sur laquelle se trouve une table carrée, enrichée de neuf pierres précieuses, et au milieu le lotus, ou *Padma*, portant dans son sein le triangle, origine et source de toutes choses. De ce triangle sort le *Lingam*, Dieu éternel, qui en fait son éternelle demeure."

In India, all conical rocks are regarded with veneration as *lingam* symbols of Siva, and caves and caverns are considered to be significant of the *yoni*, or the womb of nature, out of which all things were produced. Obelisks were *lingam* signals; pyramids, which consisted of four equilateral triangles inclined to each other, and meeting in an apex, combined the *lingam* with the *yoni*. The former was the vivifying principle, the latter the producing principle. They were symbolized by a short straight line, surmounted in the centre by another straight line at right angles to it, like a ⊥ square; also by a boat-shaped symbol with a mast, in which the boat was put for the world, the mast for the vivifying power, making it productive: this became the mystical boat of Isis, which Bryant and his followers mistook for the ark of Noah. A third form is a triple mount. Amulets of these shapes are still worn, I believe, by the Sivaites.

The T square symbol, with the handle attached to it, became the *crux-ansata*, the symbol of eternal life among the Egyptians. The *lingam-yoni* symbol of life, reversed, becomes the famous *tau*, or cross, which was the symbol of life among the Greeks, as Θ was of death, being the initial letter of θάνατος (death).* The earliest form in which this letter *tau* occurs is that of a cross, and such was the meaning of *tau* in our ancient customs. In the primitive Hebrew, Numidian, and Greek alphabets, it was represented both as a diagonal and as a rectangular cross. In the later Greek alphabet it was the rectangular lingam-yoni symbol reversed. The *tau*, or cross, is believed to have been the mark which the children of Israel made on the door-posts of their houses, by order of Moses, that, in the destruction of the first-born of the land of Egypt, the angel of death might see it, and pass over them.† It is also supposed to be the mark of salvation, spoken of by the Prophet Ezekiel (ch. ix. 4), to be set on the foreheads of the men who were not to be slain. We often see this symbol on Etruscan ornamental borders; there are several such in the museum of the Vatican, occurring as the *tau* and as the *lingam-yoni*, that is, alternately upright and reversed. As all the objects in this Etruscan museum were taken from tombs, it is probable that this also had a sacred meaning.

Sir Gardner Wilkinson has remarked that he cannot precisely determine the origin of the *tau*, or *crux-ansata*, among the Egyptians. Now, I think, there can scarcely be a doubt but that the *crux-ansata* was derived from the *lingam-yoni*, with a handle attached to it. The Coptic Christians still use it for the Cross of Christ.

The crescent moon was also supposed to symbolize the female principle; the sun, the male: something of this doctrine may occasionaly be seen in Christian churches. In Santa Sabina, at Rome, over the arches of the nave, and frequently repeated, in green and red porphyry, or their imitation, is a symbol which may be explained on this supposition: there is the sun in the embraces of the crescent moon, and a little cross is stuck over them, perhaps to sanctify their union, and they are placed on a stem which rests on the triple mount, sometimes called the *monti chigiani*, because a similar device, surmounted by a star, constituted the stemma, or arms of Alexander VII.

Kircher in his "Prodromus Coptus sive Ægyptiacus," p. 246, has some learned remarks on this subject, to show that the union of the sun and moon had reference to Osiris and Isis; and the German Ewald, in his "Emblemata Sacra," vol. i. p. 40, has a dissertation to the effect, that the moon was a symbol of the church. If this be so, we can understand the meaning of the sun thus embraced by it, although the crescent moon would rather suggest the boat of St. Peter, itself symbolical of the church, and used in this sense both by poets and painters: thus Dante causes St. Peter to exclaim,—

"O navicella mia com' mal se' carca!"—*Purg.* xxxii. 129.

But this very suspicious-looking symbol, so full of profound pagan meaning, would after all seem to be a very innocent thing, and merely meant to signify the Virgin Mary, among whose many symbols were those of the *sun* and *moon*, according to the mystical sense of the 9th verse of the 6th Canticle:—"*Quæ est ista, qua progreditur quasi aurora consurgens, pulchra ut luna, electa ut sol?*" ("Who is she that looketh forth as the morning, fair as the moon, clear as the sun?") At least this is the most Christian sense in which the symbol can be received. The sun-crowned figures of the Virgin Mary are, however, mostly taken from the woman seen by St. John in Heaven "clothed with the sun, and the moon under her feet, and upon her head a crown of twelve stars." (Rev. xii. 1.)

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* See Stephens and others. Visconti, Mus. Pio. Clem. vol. ii. p. 37.

† Compare Ezekiel ix. 4, 6, with Exodus xii. 7, 13. See Didron and other authorities. Of the wonderful influence of the cross, as a sign of power, and its exercise, see Durandus, Didron, &c.

Such Petrarca has described the Virgin Queen of Heaven in his exquisite hymn—"Vergine bella che di sol vestita," &c.

A triple mount supporting a cross would be significant of Calvary. The Buddhists of India and of China had a cross of this sort in use among them, most probably from the earliest known epoch of their religion.

The remarkable conformity between the religious institutions and forms of the Buddhists in China and those of the Roman Catholic Church, has often been noticed. A recent writer (Journal Asiatique, 5th series, vol. viii. August, 1856), remarks that it would seem as if the latter had served as a model to the former; but this can hardly be so, for Buddhism existed in India previously to the Christian ėra, and it is not probable, admitting the existence of Christian missionaries in China during the third or fourth century, that the Buddhists then for the first time copied their institutions and usages. The Kelts, who were a more ancient people than the Greeks, were also well acquainted with the use and meaning of the cross. Our Druids were accustomed in their religious usages, as is well known, to construct a cross from the noblest oak they could find, and over the top of it to write the word *Thau*, for the supreme God, which was the sound of the Greek Tau, in the Hebrew alphabet, whence it was derived. This word *Thau* was precisely the same in sound as the Scandinavian *Thor*, the mighty one, the Jupiter Tonans of the northern mythology, who with *Oden* (Mars), and *Balder* (Apollo), constituted the Scandinavian Trinity, as *Thau*, Hæsus, and Belinus, corresponding deities, did that of the ancient Britons. There can be no doubt that our Druidical circles had a symbolical meaning, and were in accordance with Oriental usages of very early times. Their *tri-lithic* details were also in all probability symbolical, and are suggestive of the Tau, two uprights supporting a cross-piece over, which was the most simple constructive form in stone.

The correspondence in form and arrangement between the Buddhist cavern temples, the *Chaitya* caves, and our early Christian churches, has been a frequent subject of remark; and what is still more remarkable is the evidence that these excavations are in imitation of structural edifices of which no traces have hitherto been found. I think this is in favour of the high antiquity of Bhuddist principles. The earliest of these caves, according to our best European authority, are those at Bahar, the *Lomas Risha cave*, and the *Sat Gurbha cave*. They consist of a body or nave, connected with a head or sanctuary by a neck or passage, and have a singular resemblance to the plan of a French church, said to be at Blanc, and dedicated to S. Genitor (see the fifth volume of the *Ecclesiologist*, in a paper on "Lychnoscopes, or Vulne Windows.") Mr. Fergusson considers these caves in the syenitic granite of Bahar, as the germs of what are found so fully developed at Ajunta and Ellora. I would suggest that their forms and situation have reference to that very early Oriental doctrine of *regeneration* which, like the lingam, has gone the round of the globe. Over the daghopa (or shrine) in the Buddhist temple caves is placed a structure called the *Tee*. It received the umbrella of state, symbolical of the royal presence, and analogous to the royal canopy, the *baldachino*, in some metropolitan Catholic churches. The meaning of the name given to this structure may possibly be explained by that of the Chinese word TE, expressing a sovereign lord or ruler, or one who judges the world. Two thousand years before the birth of Christ, *Osiris* was universally worshipped in Egypt as the saviour of souls (Rougè); he was also regarded as the incarnation of the goodness of the Deity, and as the giver of life. Osiris corresponded to *Siva* in the Indian theology, and one of his symbols was the equilateral triangle (see Patterson in "Asiatic Researches," vol. iii.): the same was a symbol of *Siva*. (*Ibid.*) Isis, the sister and wife of Osiris, corresponded to *Parvatis* the sister and wife of *Siva*. In Egypt, the resurrection from the dead, or the resuscitation of the body, was an established article of faith, and always had been: the ritual of the dead, the monuments, and paintings on tombs, and

designs on sarcophagi, show this: there is a collateral Biblical evidence, taken in conjunction with other matters, which may prove it to have been so, and we have the assertion of St. Augustine that it was so. The statement will be found in his 361st sermon, on "The Resurrection of the Dead." The words, "Egyptii soli credunt resurrectionem," &c., are quoted in vol. iii., "Dei Riti Funebri," by Rossellini, who was of opinion that the extraordinary care taken by the Egyptians of the bodies of the dead had reference to this received dogma. The Pyramids of Egypt, which were, as their forms indicate, Osiridian monuments, as well as tombs, were, I think, intended to attest the firm belief in this fact, and to transmit its memorial to the latest posterity.

The Egyptians recognized a *Saviour* in Osiris, who was the type of the regenerated soul, and of the resuscitated body, through whom and in whose name every Egyptian hoped to obtain a blessed immortality in heaven. The transmigration of the soul, as received by the Egyptians, appears to have been one through the heavenly mansions, passing from glory to glory. The *Heron*, which was a symbol of Osiris, was also a symbol of the first transformation of the soul in his paradise. (M. Rougè.)

The deceased, on admission to the heavenly state, was supposed to be born again, and to commence a new life, cleansed from all the impurities of earth. Now, this was precisely what was meant by *Siva* and his operations, and which was symbolically set forth by the equilateral triangle, and monumentally by the pyramid. Since Siva and Osiris were in this sense identical, can we doubt that the Egyptians, by their sepulchral pyramids intended to signify the same thing, that the soul of the deceased had ascended on high, while his body remained below, protected from the injuries of time, at some future period to be reanimated by its spiritual partner. The great number of tombs about the Pyramids would seem to strengthen this exposition of their meaning. The Greeks believed the soul to be a particle of divine etherial fire,—at least this was the doctrine of Heraclitus, to whom Plato and others were subsequently much indebted,—which particle, on being released from the body, sought to return again to the sphere from whence it had descended, and they regarded the pyramid as a symbol of the soul. The pyramid was, in fact, the form assigned by Plato to the particles themselves of elemental fire; and fire, from the days of Moses to our own, has been held symbolical of the divine presence: hence in the name which the Greeks gave to this geometrical figure, πυραμις, from πῦρ, fire, we may perceive that they recognized in it a sacred symbolical meaning.

Osiris was also the judge before whom the soul appeared on its separation from the body. Representations are frequent of this final trial, in which the actions of the deceased are weighed in the divine balance. The scene transpires in the Hall of Amenti, or Hades. Osiris is seated on his throne, *Horus* and *Anubis* superintend the process, and *Thoth*, the recorder, or, as his legend denotes, "the Lord of the Divine Writings," inscribes the result on his tablet for presentation to Osiris. In one scale is a vase containing the actions, or the heart of the deceased; in the other, a figure, or the symbol, of truth, an ostrich feather. If the individual, on being thus weighed, was found wanting, which rarely happened, he was sent back again to earth in a degraded form; if not, after a purgation by flame, he was admitted to the celestial abodes; but if incorrigibly bad, was condemned to eternal fire.* A similar representation is occasionally met with in Christian churches, where, in place of the Egyptian ministers, we have Michael the Archangel and the Devil, who is introduced among the *dramatis personæ*, artfully endeavouring to deceive him.

There is a very elaborate and interesting example of this over the portal of the cathedral of Autun dedicated to St. Lazare: M. du Sommerard, in his great work, "Les Arts du Moyen Age," has given

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* See a plate of this in Wilkinson: second series, plate 88. See also "The Egyptians in the Time of the Pharaohs," p. 130. See Rougè, Rossellini, Lepsius, and others.

a plate of it (Plate xxi., Part iii.), and M. de Caumont has also given a representation of it in his "Abécedaire," p. 146, 2nd edition.

The lizard, which a Satanic assistant is about to toss into the scale, to weigh it down in his master's favour, is a symbol of sin, and reminds one of the crocodile, which with the Egyptians had this signification. A fresco of the same subject is said to exist on the south side of the chancel wall of Preston Church, Sussex; in this the sinner is saved by the timely intervention of the Virgin Mary.

The fundamental religious doctrine of the Egyptians, touching the Deity, was His *unity*—when this unity became active it received different names, and these operations being personified, in objective forms, gave rise to the popular gods of the Egyptians.*

In the formation of these figures, mostly human bodies with the heads of various animals, as that of the *ibis*, for Thoth, to whom that bird was sacred; that of the *shakal*, for Anubis; of the *sparrow-hawk*, for Horus, of whom these were symbols; it is obvious that they were purely ideal representations, and that it was never intended that they should be taken for realities—they were symbolical figures, and nothing more. But Moses, who followed the Egyptian learning in many things, very wisely prohibited all images; had he not done so, the Hebrews might have had as many gods as their neighbours, for the Deity received from them, also, many names, according to his various operations.

The primitive temples of the Egyptians were in harmony with the monotheistic character of their early religion, and consisted of a small quadrangular chamber, or sanctuary, containing the sacred image and the altar: it was entered by the priests only, the people assisting without the entrance in front. Subsequently a porch was added, and the inner chamber then became the *adytum*. When triads were introduced, instead of one inner chamber there were three, and the ante-room, or porch, which had been in part thrown open by the substitution of columns, with a low screen between them, instead of the wall, was replaced by a transverse corridor: an avenue of sphinxes, composed of a lion's body and a human head, the symbol of force combined with intelligence, led from the temple to the *pylon*, or gateway of the enclosure, which was planted with trees, and became the "sacred grove," or *temenos*, in imitation of man's primæval places of worship, and possibly in accordance with a universal primitive tradition. The direction of these temples was usually east and west,—according to Dr. Kitto, at least more frequently than not. To these elements of a complete temple additional halls and avenues might be added, as we know that they were, from time to time, by the kings, the symbolical derivation of whose authority was set forth over the principal portico in the winged sun with the Eureus, the symbol of the supreme ruler. This general arrangement was very like that adopted by Moses for the Tabernacle in the wilderness.

It is not my intention to show the correspondence between the "ark of the covenant," the "cherubim," and other matters touching the Hebrew ritual and rites, with similar symbols and usages among the Egyptians: what Selden and others intimated long ago has now been satisfactorily proved, and can no longer be doubted: the correspondence shows that Moses deemed the profound symbolical lore of the Egyptian priests, by whom he had been carefully educated, their forms, dresses, and processions, with the sacred ark, and all the pomp and circumstances of the sacerdotal order, not unworthy of imitation in the religious services and ceremonies of the Jews. The general arrangement of the Egyptian temple was followed by the Greeks, and to a certain extent by the Romans, and from the Romans passed into Mediæval Europe, and so has descended to ourselves, modified by elements

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* Wilkinson's "Popular Account of the Ancient Egyptians," vol. i., pp. 327-8; Spineto's Lectures, &c

derived from the far East, and by a symbolism of earlier origin. In the series of Egyptian orders symbolism is obvious. To a people so symbolically disposed as were the Egyptians, and among whom the equilateral triangle was a sacred conventional sign, the triangular form of the stem of the papyrus may have recommended it to their special notice, and we find the imitation of this plant, or of four such plants bound together, the earliest of the symbolical series of orders. The capital represents the flower in the bud. In the next, the fourth of Sir Gardner Wilkinson's arrangement, we have what he calls the full-blown papyrus capital. In the following we have the palm-tree capital. At one time the palm-tree was the sacred tree in the Paradise of Osiris, and the palm-tree, surmounted by an ostrich feather, was significant of Lower Egypt, or the happy West. It occurs in this sense in the zodiac of Dendera.

The other orders are those with the Isis-headed capital; the full-blown lotus-headed capital, sometimes surmounted by the head of Isis and her symbol; the Osiride order; and that with the Typhonian monster: the symbolical meaning of these no one can doubt.

This Typhonian monster was, I suspect, a somewhat Greek and satirical version of *Seth*, the evil principle, in contradistinction to *Osiris*, the good principle; and probably holds the same relation to *Seth* as the scarecrow of the monks does to the *Satan* of Scripture. The symbol of sin among the Egyptians was the gigantic snake *Apophis*. The lotus plant was as sacred with the Egyptians as with the Indians. According to Rougè, it was the symbol of the new birth; but Lepsius considers that it was the symbol of inexhaustible life; Rossellini regarded it as symbolical of the female principle among the Buddhists. The bodies of the saints are reproduced from the Lotus, pure and holy; it may therefore be held symbolical of the womb of Nature, and, in a spiritual sense, regeneration. No plant was so great a favourite with the Egyptians as was this.

Along with Egyptian architecture, some notice should be taken of Egyptian lions. In Egypt the lion was symbolical of the overflowing of the Nile. When the sun was in *Leo*, the greatest rise took place; hence *lions' mouths* came to be a speciality of water-spouts, as lions themselves were of fountains of water; but it is chiefly with the *sun* that their connection lies. Horus, as the sun-god, had his throne supported by lions (Rougè). The child Horus, seated on a lotus flower, expanding as it rose to the surface of the water, was symbolical of the sunrise, and of the eternal youth of divinity. Lions were also associated with the worship of Mithras, or the sun. The lions at the gate of Mycene are supposed to have been connected with Mithras; but I think this is a mistake. Lions, oxen, and cherubim—a rather singular fellowship—were among the brazen ornaments of Solomon's temple (1 Kings vii. 29). Two lions stood at the side of Solomon's Throne (1 Kings x. 19). So they did also at the sides of the throne of the king of Egypt, as we may see on monuments; and possibly the son-in-law of the Egyptian monarch may thence have taken the idea; but the symbolical meaning of lions in this situation had reference to the administration of justice. It is probable that the Romanesque architects derived their lions from the Bible record; and their position at church doors, frequently with the columns of the porch resting on their backs, had a reference to the custom of administering justice there, and the rendering of certain public acts, so that the porch, with its lions, became a tribunal, and hence the formula which many public acts and documents bear, "*inter leones.*" M. de Caumont has some interesting remarks on this subject. The lions over the gate of Mycene had probably a similar meaning: they were there as symbols of justice and judgment; for the gates of cities in the olden time were often made the places for administering the law. I once thought that the lions of Daniel—so frequently seen on early Christian sarcophagi—might have had something to do with those at church porches; but I believe the association of lions with places of justice is of much earlier date than the days of Daniel.

Among the Assyrians, Beltis, the female form of Baal, or the lord, and consequently the queen of heaven, was represented standing on a lion. The lion is an emblem of solitude as well as of royal power. In Christian symbolism, lions are associated with Paul the Hermit; and, according to the golden legend, they dug the good man's grave. A lion is given as a companion to St. Jerome; and a unicorn is put by the side of the fair St. Justina, to signify her purity and virtue.

A history of animals in reference to their symbolical characters, while it would show much that is interesting in their habits and manners, would at the same time throw considerable light on the theology, mythology, and art history of the ancients.

The Greeks, by not caring to ascertain the symbolical value of animals' heads, came to treat the gods of the Egyptians with very little respect. Wit here took the place of wisdom, and they sought to turn into ridicule what they did not care to understand.

Every country has had its sacred tree, and some countries have had more than one. Egypt had several; the earliest was the palm tree, the date palm (*Phœnix dactylifera*); after that the sycamore tree (*Ficus sycamorus*), and subsequently the Perséa (*Balanites Ægyptiaca*). The first of these may have been sacred to Osiris, it was so to the sun; the second was sacred to *Netpe* (or *Nutpe*); the third was sacred to *Athor*.

The representation of the palm tree as the Tree of Life, occurs on a very early *stèle* in the Berlin Museum. It was found by Dr. Lepsius, in the village of Abousir, near the Great Pyramid. From the upper part of the stem of the tree proceed two arms, one of which presents to the kneeling figure of the deceased, a tray of fruits; the other pours from a vase a stream of living water, which the deceased conveys to his mouth. Beneath the tree are two herons, feeding from equilateral triangles,—extremely symbolical. We may sometimes see similar symbols of birds feeding from the equilateral triangle on Christian monuments. There is one such in the Church of Sta. Maria, in Trastevere. I took a sketch of it when last in Rome. The stèle is broken; and little is seen of the figure that was behind the principal one. Dr. Lepsius was kind enough to inform me that he considered this stèle anterior to the fifteenth century, B. C.

The sacred tree, the Tree of Life, occurs on the Nineveh tablets as a conventional palm-tree, surrounded by an enclosure of *palmettes*, attended by winged deities, or ministers holding the pine-cone symbol of life, which, in Assyrian sculptures, takes the place of the crux-ansata in the hands of the Egyptian deities.

The palmette passed from the Assyrians to the Greeks, and formed the crowning ornament of their most beautiful temples. It appears also to have been a symbol among the Etruscans, and, together with the palm-tree, will be found on Etruscan sacred utensils.

I think the fleur-de-lis, which appears as a royal cognizance in the hands of the Merovingian princes as early as the fifth century, was derived from a conventional imitation of a palm-tree or palmette.

The Tree of Life mentioned by Moses (Gen. ii. 9) growing in the midst of the garden of Paradise, has always been understood as the palm-tree—the date palm, *Phœnixda ctylifera*, the same as shown on the Egyptian stèle, a work of art at least contemporary with the Pentateuch, if not anterior to it. St. John the Evangelist alludes to this tree in describing *the Tree of Life* on either side of the river of water of life. He says that it "bare twelve manner of fruits, and yielded her fruit every month; and the leaves of the tree were for the healing of the nations." The date palm was popularly believed to put forth a shoot every month; hence the tree, or a branch of it, became the symbol of the completed year. The leaves were used for writing on. No tree, in fact, was so worthy of this distinction being conferred upon it, and in Christian mosaics the Tree of Life is

invariably represented by the palm-tree. It appears to have passed from the Jews to the Christians, for we read that it was largely introduced in Solomon's Temple, both on the walls of the sanctuary along with the cherubim, and most probably had been on the drapery of the Tabernacle in the wilderness, along with the cherubim, as also on the utensils of the Temple. (See 1 Kings vi. 29, 32, 35; and vii. 26.)

Drawing IX. is the palm-tree as the Tree of Life from the mosaic in the apsis of the church of the saints Cosmo and Damiano, in the Roman Forum. On the branch of the tree is perched the Phœnix, with a glory of seven rays. That the Phœnix was a symbol of the resurrection, there can be no manner of doubt. In this sense the Phœnix was a very ancient mythical creation. Dante alludes to it, Inf. xxiv. 106-8.

"Cosi per li gran savi si confessa,
Che la Fenice muore e poi rinasce,
Quando al cinque centesimo anno appressa."

Thus the learned confess that the Phœnix dies and is born again, near to its five-hundredth year (see Ovid's "Metamorphoses," lib xv. v. 392, *et seq.*) Ovid associates the fabulous bird with the palm-tree as preparing its funereal nest among the branches, "tremulæque cacumine palmæ," from whence, on its death, another little Phœnix rises up. It is a doubtful point whether the tree, *Phœnix dactylifera*, gave name to the bird, or the mythical bird to the tree; possibly the well-known fact that when an aged female palm-tree was burnt down to the roots a new tree sprung up amid the ashes of the old one, may have been the origin of the fable (see Pliny).

Over the apsis of this church is the symbolical lamb on an altar between the seven golden candlesticks, with five angels above forming a crown; below, in the apsis, is Christ as the lamb, with a simple glory, standing on a little mound, from which flow the four gospel streams of living water, sometimes called the rivers of Paradise, between twelve sheep for the disciples.

In the church of Sta. Maria, in Via Lata, there is a similar arrangement, but here the lamb has a crucical glory. Above these symbols is a very large figure of the Saviour between the four Evangelists, along with S. Felix IV., the original founder of the church, and S. Theodore; and beyond these figures are two palm-trees.

In Christian symbolism the cross, and the Tree of Life, are identical, and one may take the place of the other. This is further shown by early Christian mural monuments in the Museum at Lyon. They are very rude, but very significant. We have here faithful Christian souls as birds (doves) feeding on a tree, their spiritual food; two of these bear the cross on their heads, as significant of their having borne it after Christ. In the lowest of these sketches we have the cross and Greek Rho, in place of the tree; thus showing their identity in meaning.

"The cross and Christ," says M. Didron, "are one and the same, therefore, the Tree of Life and Christ are one and the same."

That the palm-tree was a type of Christ, is rendered probable by its being figured on the walls of the Sanctuary of the Temple along with the Cherubim; and this probability becomes almost, if not quite, a certainty by the spouse of the church being thus spoken of by Solomon. In the Song of Solomon, which is usually recognized by divines as expressive of the love of the church for Christ, we read, ch. vii. v. 8, "I said, I will go up to the palm-tree, *I will take hold of the boughs thereof.*"

(Various correspondences might be brought forward, both Scriptural and ornamental, to show this, which is also stated by some of the early writers of the church, and gives to the palm-branch, as borne by Christian martyrs, a peculiar value beyond its ordinary symbolical sense.)

With the Tree of Life was associated the Water of Life (and so also with the sacred trees the

Tree of Life in the Egyptian theology.) Water is represented on Egyptian monuments by parallel zigzag lines. This was its earliest and its simplest form, and it is seen on the rudest pottery of the flint and bone age.

It also occurs on Etruscan and other ancient vases, and around doors in Assyrian architecture, as seen on one of the alabaster slabs from the principal hall of the north-west palace of Nimroud, in the British Museum. I believe it to be the origin of the zig-zag moulding over Early Norman, and perhaps some Saxon doors, and which is there most appropriately placed as symbolical of the water of baptism: it is true, it also occurs over windows, but chiefly over doors, which is its proper locality.

The Tree of Life, recognized by Mr. Lewis over the door of Kilpeck Church, and supposed by him to be symbolical of the Trinity, and proceeding "from a foundation of light," is meant for a plant of the order *Nymphæa*, or water-lily tribe; it is not much unlike the sacred lotus, and grows out of the water, indicative of the new birth, or regeneration. What Mr. Lewis calls fruit, may be meant for buds; they look more like pine cones than bunches of grapes, but if intended for the latter, the design becomes quite conventional.

Over the side-door of a church at Mavigny (Calvados), in the tympanum, is a symbolical tree of life, which M. du Caumont thinks may be meant for the Hom, the symbolical Tree of Life of the Persians. Two animals are feeding on it.

The *pine cone*, which, in the hands of the Assyrian deities, or ministers, corresponded to the *crux-ansata* in the hands of the Egyptian personified attributes of Deity, and had the same meaning, also corresponded in Christian symbolism to the Cross and the Tree of Life. There is a very interesting illustration of this on the ivory tabernacle in the sacristy of the cathedral of Sens. (The subject has been reproduced by the Arundel Society.) The pine cone is here placed between two faithful Christian souls, figured as peacocks; and by the palm-branches attached to their necks, they are shown to have been martyrs also. Christian souls are less frequently figured as peacocks than as doves, but such occasionally occur. There is in the cathedral of Vienne, in Dauphinè, a sarcophagus containing the remains of an ecclesiastic of rank, on which two peacocks are represented feeding on the grapes of a vine growing out of a vase or sacramental cup. The meaning is obvious.

The flesh of the peacock was in early times believed to be incorruptible, and hence it was regarded by the primitive Christians as symbolical of the resuscitated and incorruptible body. But it was also thus introduced by the Gentiles before them.

In the engraving of "The Paradise of Osiris," found depicted on a wall at Pompeii, the peacock occurs along with the dove and the heron, among the sacred trees, the palm-tree and the perséa.

Christian souls have also been figured as griffins. There is a tablet at St. Mark's, at Venice, a cast of which is in the South Kensington Museum, and one also in the Crystal Palace, on which two griffins are feeding on a vine that rises on a tripartite form from a vase: and that it might be understood what this vase is supposed to contain, the *thyrsus* of Bacchus is placed in it.

But the griffin, which among the Gentiles was a symbol of Apollo, whose car we may often see drawn by griffins, was properly the symbol of Christ, and in this sense is introduced by Dante:—

"La fiera,
Ch'è sola una persona in duo nature.'"—*Purg.* xxxi. v. 81.

The eagle head and wings representing the Divine nature; the lion's body, the human nature.

On the baptismal font of Winchester Cathedral, a cast from which is in the Crystal Palace, two doves are approaching to drink out of a vase, in which is placed a jewelled cross: the cross here takes the place of the *thyrsus* of Bacchus in the tablet of Venice.

In the arms impaled on the money of Gregory XVI., two birds are approaching to drink out of the sacramental cup, over which is the star of Bethlehem.

Thus we have the *crux-ansata*, the *tau*, the *pine cone*, and the *thyrsus of Bacchus*, corresponding in symbolism to the same thing, the *cross of Christ*, and all significant of that primæval doctrine which the sacred tree, the Tree of Life, was intended to figure.

Light.—From the consideration of LIFE in its general and special, animal and vegetable forms, as sources of symbolism, we pass to the consideration of LIGHT.

In the worship of intellectual light, or reason, the *sun*, as the visible source of light and life, came to occupy an important place in religious symbolism, and consequently had much influence on art. Light by the sacred writers is invariably associated with the Divine life and love, and the children of light are the partakers in this life, they are the sons of God.

"God, under his visible form," observes M. Didron, "is light, his most constant natural symbol;" and when our Saviour says, "I am the light of the world," he thinks the words should be taken as much in a literal as in a figurative sense,—God is also "love."

The sun being looked upon as the visible symbol of Deity, that is of the supreme ruler, temporal rulers, regarded as the delegates of Deity, came to receive the titles of sons and descendants of the sun. Thus the kings of Egypt were called "Sons of the Sun," and the kings of Persia, I believe, are so still. One of the titles of the Emperor of China is *Tëen-tsze*, the Son of Heaven; and the Imperial family are called *Tëen-hwang*, significant of their celestial descent. (See "Morrison's Dictionary.") Something of this parentage passed from the East to the West, through the Christian emperors of Constantinople, who are occasionally represented with a celestial glory, or nimbus, as are also several of the German emperors. The symbol in the East signified power rather than holiness. A head of Constantine on his arch, is thus characterized. Its introduction into Christian art was not until the fifth century, or perhaps a little later.

By the fathers of the Church Jesus Christ was named the "*New Sun.*" In the Roman Church, the *Ostensoir*, containing the *hostia*, or sacred wafer, appears as a radiating sun, and the outer portion of it is so called. Philology here steps in to confirm the deductions from symbolism, and shows that all divine persons are very properly distinguished by glories, since the word divine, in Latin *divus*, is derived from the Sanscrit root *div*, to shine. Durandus has a remark on church windows that they symbolically transmit the light of the true sun—that is, God—into the hearts of the faithful. Our Pointed Christian architecture, with its clerestory windows, is here symbolical of the truth that "Light has come into the world." A symbolism is shown still more in some cathedrals in France.

Having thus endeavoured to show that the use of symbols in art, symbolical treatment, and symbolical principles are derivable from the two great fundamental agents in nature, *Life* and *Light*, either separately or combined, and that their influence through architecture, sculpture, and painting, as also through the sister art of poetry, has descended from the most remote antiquity, in a tolerably connected series of representations, down to our own day, it remains only to point out how our national Christian architecture derives its forms and proportions from the principles already laid down.

The symbol of life, even of life eternal, has been traced from the earliest period of monumental history, along with the equilateral triangle, the symbol of the generation of all things, of the source of all life, of Siva, of Osiris, and of all trinities in unity. Nor has their union been confined to the earth; man, whose ideas, derived from sensible objects, are reflected back to him from the heavens, as the subject of his speculative thoughts, has transferred these images also to the starry firmament, and, in the southern hemisphere, the constellation of the cross shines with surpassing splendour along with the equilateral triangle.

But it is in reference to that intellectual and Christian heaven of the soul, of which the Church on earth is the type and prefigure, that we must now consider the symbol of life and its ancient associate the equilateral triangle. And surely nothing can be more in harmony with nature and revelation than, in Christian temples, where the great doctrines of life and immortality are taught, not as mysteries to the initiated only, but as the plainest of facts are preached openly to all, that the architecture of these sacred edifices should in its forms and details be regulated by those symbols which from the earliest times have been used to express them—the cross and the equilateral triangle. In Christianity there is a gathering in, as it were, of all truth that has been scattered through the world from the day when first our little planet went spinning on its course, the habitation of human beings rejoicing in life and light; and in that style of architecture to which the growth and development of Christianity in its palmy days gave rise, we recognize a structural confirmation of this fact in the principles that prevailed and regulated the whole. Our cathedrals, and the great Christian temples in France and Germany, and some in Italy, are built in the form of the cross; and the equilateral triangle has regulated the general proportions of the elevation, and often of its details. This has been shown by Cæsar Cæsarianus in his translation of Vitruvius, of whose ingenious observations Mr. Hawkins, in his History of Gothic Architecture, has given an account.

Brown Willis, in his preface to the second volume of his "History of Abbeys," p. 8, has noticed that in most of these stately edifices the height was equal to the breadth of the body and side aisles. Agincourt, also, has recognized this in reference to certain Gothic façades (Tav. xlvi., figs. 21, 22). The Cathedral of Salisbury and Westminster Abbey are certainly designed, says Mr. Hawkins, on a system of triangulation; and there cannot, I think, be a doubt that the triple ratio has regulated the principal features no less than the details of our most perfect examples of Christian architecture.

These principles have been tested and successfully applied more recently by various architects. The best account I have met with of them is in a paper read by Mr. White, at the anniversary meeting of the Ecclesiological Society, June 2nd, 1853, and printed in the fourteenth volume of the *Ecclesiologist*. Mr. White states, "the figures applicable to the setting out of Mediæval buildings are these:—1st, the square; 2nd, the equilateral triangle; 3rd, certain arcs described upon diagonals and bases of the same. We are chiefly concerned here with churches: now, the length of the nave being given, we can, by dividing it into bays, and setting up upon each bay equilateral triangles, or certain subdivisions of the same, show an accurate method of setting out its breadth, the length and breadth of the chancel, and other proportions of the ground plan. Upon the ground plan thus obtained we can, by the employment of certain angles, set up points for the heights of the several windows and arches, the roofs of the several parts, the stages of towers, and every thing else; and when all these heights have been set up, we can then, and not till then, proceed to work out the relative widths of the windows and other minor parts, with every detail, even to the plan of the jambs and mullions, and the section of mouldings." In fact, as Mr. White observes, "the equilateral triangle appears to be the basis of the proportions employed in the most beautiful of all our styles,—the untraceried and traceried first pointed."

Pointed Christian architecture thus becomes itself a symbol, and a very significant one, with which its sculpture, paintings, and ornamental features all conspire to create a consistent and edifying whole.

Offspring of a Christian philosophy, and of Christian feelings; light, aërial, and heavenward in its tendency, it rises up with a spirituality entirely its own, and, though we cannot subscribe to the dreams of Durandus, we cannot withhold from it the entire credit of that symbolism it so perfectly conveys. The enlightened Greeks in their sacred edifices combined, to the utmost of their ability, on

philosophical principles, the *grand*, the *beautiful*, and the *true*.—The *grand*, as displayed in form and magnitude. The *beautiful*, as manifested in form, proportion, arrangement, and colour. The *true*, as shown in the construction, in the character of the building, its materials, and workmanship, in which nothing false, nothing meritricious, nothing unmeaning, found a place.

Our pious forefathers, with a conscientious integrity, fully carried out these principles of the Greeks, and in the noble monuments they have left us of their Christian munificence, have shown how the *grand*, the *beautiful*, and the *true*, may receive from Christian motives their highest development.

Mr. White, Fellow, had great pleasure in testifying his sense of the value of Dr. Barlow's paper, as calling the attention of the Institute to Christian symbolism as a science, because he thought that symbolism was as essential to architecture as poetry was to literature. He had long entertained this view of the subject, which was not generally taken. He regarded symbolism as the poetry of architecture. He looked upon it, not as a mere fanciful theory, but in the light of figurative language, which was the only possible means of conveying abstract religious truth, or of making it accessible and comprehensible, to man. As Dr. Barlow truly observed, the use of symbolism had been universal, in all ages and in all countries, and it might be traced even to antediluvian sources. In all the early symbolism, which had been continued to the present times there appeared to be three essentials:—first, a symbol of the divine essence; secondly, a symbol of ritual or of sacrifice, which was universal in all systems; and thirdly, the symbolism of teaching, derived from the preceding. The first and most prevailing symbol was the triangle. It was said that there was in the Jewish Church a Tradition independently of the written Word; and that tradition was forbidden to be revealed except to the priests and those who were the keepers and witnesses of the written Word, and the object of this, in the Jewish as in other religious systems, appears to have been,—first, to make a bond of union in each church and each religion, and secondly, to separate them entirely from all others, and to prevent any one who was unable to explain the mysteries from obtruding into the priestly office. He believed that the sign of the cross written under the symbol of the Trinity, and referred to by Dr. Barlow, was the sign which our Lord referred to when he spoke of the sign of the Son of Man appearing. He considered that the application of symbolism in Christian churches had this effect,—that its presence and influence was felt, even although those who felt it had no knowledge of that which was represented. Thus what he should call the proper ritual arrangement of a church, with its porch, font, nave, choir, chancel, sanctuary, altar, etc., simply and solely symbolical as they were, had an effect on those entering the building, though their attention had never been called to the symbolism itself. Some such system, therefore, should be carried universally out, although if it were but carried to a fanciful extent, its value might be over-rated, and its effect depreciated.

Mr. J. W. Papworth, Fellow, objected to those remarks, as the meeting had been told first that symbolism was "the only possible means of conveying abstract religious truth, or of making it accessible and comprehensible, to man," and secondly, that the results of symbolism "had an effect upon those who might enter the building, although their attention might never have been called to the symbolism itself." Expressing admiration of Dr. Barlow's drawings, he considered that the paper contained an extraordinary quantity of assertion without proof, probably due, considerably, to remarks made by pseudo philosophers, especially by those of the last century, as might be seen in the "*Anacalypsis*,"* &c. One man sug-

* "Anacalypsis, an Inquiry into the Origin of Languages, Nations, and Religions," 4to., London, 1736, by Godfrey Higgins: and "Celtic Druids," 4to., London, 1829, by the same author.

gested something might be a symbol of somewhat else, another approved the notion, a third declared that it had been held to be such a symbol, a fourth asserted that it was so received by general consent, and at last a fifth considered it desirable to pray for the conversion of those who doubted the propriety or necessity of its adoption.

Dr. Barlow stated that his own remarks were based upon the original authorities, and had no reference whatever to Mr. Higgins, whose *ipse dixit* he had in no way relied upon.

Mr. J. W. Papworth, accepting that confession, contended that the very authorities cited did not justify the deductions drawn from their works where the writers were trustworthy. Amongst those who could not be considered authorities for symbolism, in Christian art especially, he would mention three named by Dr Barlow, viz. Cyril, Philo of Alexandria, and Origen. Of the first it would be enough to say that his inventions and credulities supplied him too frequently with the bases of his writings, and that he is undoubtedly heretical; the second was a Platonizing Pharisee; and the last is convicted of having tampered with the words, statements and facts of Holy Writ to suit his own views. He regretted that there was scarcely a sentence which they had heard from Dr. Barlow to which a dissent might not be either confidently intimated or positively maintained. Referring to the question of churches being founded upon the system of the triangle, alone or in combination with the circle, he observed that, although he believed in a conventional theory of construction in certain Mediæval times, he admitted that the square frequently, and not the triangle always, had been the guide; but some evening the Institute would perhaps give him leave to explain his notions of the way in which a cathedral was built in the middle ages. It was quite possible that a hobby might be ridden to death, and he thought that had really been the case in the instance of the evening's paper.

Mr. A. B. Hope, M.P., Hon. Fellow, observed that symbolism was necessary for originality, and the Mediæval artists who did not symbolize were obliged to resort to direct imitation. But whether symbolism should be carried to the extent advocated by Dr. Barlow was a matter for consideration. A discussion on the theory of symbolism could never be useless, whether leading or not to the point which it was desirable to attain.

Mr. G. G. Scott, Fellow, remarked that the triangle was an exceedingly beautiful form, and had no doubt been adopted by Mediæval architects in many cases, but he did not think it desirable to lay down such strict geometrical laws as had been advocated by Mr. Papworth and Mr. White.

Mr. White said all that he affirmed was, that in the best works of all ages some accurate geometrical and mathematical principle was carried out.

Mr. G. G. Scott said there could be no doubt of that. Many Mediæval buildings were based upon the square, and many on the triangle, and this could be proved by the mere application of the compasses, and without any subtle course of argument.

Mr. Street, Fellow, believed there was no building extant which could not be reduced to the principle of either the square or the triangle. Some years ago, when working from Mr. Scott's plans, he thought he could prove that all the works of that gentleman were designed upon the most scientific principles, and he fancied he had hit upon some secrets of Mr. Scott's, but he now believed that any building might be brought within any of the three principles,—the square, the diagonal, or the triangle.

Mr. G. G. Scott expressed his opinion that Mediæval architects, who were all men of common sense, designed their buildings first with reference to their size and purposes, and that proportion and symbolism were secondary points.

A vote of thanks to Dr. Barlow was unanimously passed, and the meeting adjourned.

AN ADDRESS,

Delivered at the Ordinary General Meeting of the Royal Institute of British Architects, April 23rd, 1860. By C. R. Cockerell, R.A., President.

After the presentation of the Royal Gold Medal to Mr. Sydney Smirke, R.A.,

The President addressed the meeting with reference to the forthcoming election of a President in place of the lamented Earl de Grey, in whose position he had the great honour to have been placed by their unanimous desire. He had gratefully and most respectfully accepted that honour, *ad interim* only, doubting the sufficiency of his health to enable him adequately to fulfil so resposible an office. It was customary to elect the other officers of the Institute at the same time.

He congratulated the Institute on the success of their labours during the past sessions, and on the interest with which those labours were viewed by a large and increasing class of society. Founded upon the broadest principle of free discussion, by lectures and the publication of their deliberations, and by the agitation of the great questions of interest to the art and science of architecture, they obtained the best results of universal experience and scientific acquirements in the building art;—the Institute stood amongst the most useful and eminent of the country in the present day. He was proud to say that the Institute had been the growth of these our times, having (from a variety of causes) in no sort existed in his early days. He had great pleasure in seeing before him on this occasion its chief originators, full of experience and activity towards the further development of its valuable and interesting objects, namely, the advantage and honour of the *ars regina* (as architecture has been rightly termed) in this great country. He congratulated them on the success which had attended their efforts, and the gratitude we should all owe them for the fruits of their zeal which we saw before us. To the distinction which society was at all times ready to award to merit, the Institute had added their seal of competent approbation, and proposed new motives to emulation and proficiency, by honours and by testimonies, which would greatly enhance the estimation of their profession and the position in society to which they laid claim. It was remarkable that since the decline of Freemasonry in this country, from political and other causes in the beginning of the last century, no body of this authority had existed, and it was a creditable fact that our great Sir Christopher Wren was the last to recognize the importance of this venerable institution, and to uphold it amongst the profession and the society of this country during his long life. There could be no doubt of the existence of such societies in the classical times, fully acknowledged by the Romans under the title of *Collegia Fabrorum*, and of their much earlier date in Egyptian and in Grecian times, testified by the uniformity of practice discovered in their remains throughout classical antiquity.

The Institute had thus become the restorers of a society essential to all civilized times, and esteemed of the greatest benefit, as far as history could reach; it was, therefore, with peculiar complacency that the present condition of this Institute might be contemplated, after an existence of twenty-five years. By the self-supporting and independent zeal which had originated the Institute, they now stood in enlarged and sufficient premises, with new advantages; a competent library had grown up around them; a collection of invaluable drawings and of records was forming, and an exhibition-room, in which were exposed annually those original designs which exhibit the merits and expose the defects of our actual school, to the infinite advantage of the art in this country.

Nothing could attest more strikingly the liberality on which the Institute was founded than the fact that its present state of existence was derived from the gratuitous efforts of its own members,

and that most of the offices, especially those charged with heavy responsibilities, were entirely gratuitous.

It was most gratifying that the national advantage of the Institute had been immediately recognized by the Throne; that they had long enjoyed Her Majesty's special protection, evinced by the annual gift of a gold medal, as a Royal recognition of merit, to be awarded by the Council of the Institute, either to our own or to foreign architects of acknowledged merit.

Thus we were proud to stand in a due equality of rank and usefulness with the most conspicuous institutes of the continent; and there could be no doubt that, so established, it would flourish to future times to the great advantage and honour of our country. Similar institutions had been formed throughout the provinces of this country; we had the honour to hold an active and courteous correspondence with foreign societies; and we maintained a respectful and beneficial harmony with those of previous date in our own country.

Thus prepared and qualified for the culture of the historical and scientific departments of this multifarious profession, they held in particular honour that imaginative faculty which formed the basis of the art, and which was the source of that invention ever adapting the discoveries and the changes of society for the use and dignity of the country.

The graphic arts constituted the language by which these adaptations were chiefly explained and recommended to society, and were especially required by the accomplished architect. By these the knowledge of form and composition, the sense of fitness and propriety, and of all those considerations which came within the meaning of the terms taste and judgment, were best learned and conveyed to the employer. The union of those graphic arts with the knowledge of the exact sciences had always been deemed essential in every academy of fine arts, and architecture had ever been associated with painting and sculpture as necessary to its successful practice.

So rare and so difficult was the union of the scientific and the graphic departments of this art in the same person that theoretic writers were at variance as to the preference to be given to the one or the other faculty. Thus the learned Rondelet defines architecture, as "a *science*, the object of which is to direct the operations of every sort of building, so as to unite convenience, solidity, and beauty of forms. Architecture is not therefore only the art of delineating, and profiling the orders, Greek and Roman, and others, as many authors presume, but a vast science; the purpose of which is to provide for the security, the convenience, and the magnificence of nations; and to give them that lustre and prosperity which true civilization implies. Most modern architects are rather decorators than constructors, aiming, like the painter and the sculptor, chiefly *to please*—indulging in captivating but often impracticable designs, induced by their associations with the imaginative arts of painting and sculpture, and patronized unduly by governments, attracted by splendour and ostentation rather than by the graver merits of solidity, convenience, and durability." Then again said Rondelet:—"Would it not be profitable to distinguish equally the three branches of our art—convenience, solidity, and decoration,—by encouragements of rewards and honours, and consequently, by professors of each separate department, for the culture of the several talents on which the success and merit of a work ultimately depend?" While the no less accomplished Q. M. de Quincy declares the necessity of the intimate union of the graphic arts: "Drawing," says he, "under which name we understand, not *simple delineation* only, but the *study of the forms* of the human body, and of nature in general, and which constitute the base of painting and sculpture,—drawing should enter as an essential study into the practice of the architect. Some authors have asserted that no one *can be a good architect* without having been *a good painter* or a good *sculptor;* and if we look into antiquity we shall find many authorities in favour of that association of studies or professions of architecture,

painting, and sculpture. In Italy, especially during the finest ages of art, we find the union of these arts in the most celebrated architects. Witness the names of Giotto, Orcagna, Mantegna, Michelangelo, Raffaelle, Giulio Romano, Polidoro, Vasari, Tibaldi, Daniele di Volterra, G. di Bologna, Domenichino, Bernini, Algardi, &c. But confining ourselves more particularly to architecture, we find excelling in the sister arts also, Brunelleschi, Alberti Ammanati, Sansovino, San Gallo, Bramante, Vignola, &c., whence it results that the finest works in Italy are the fruits of the combined arts of painting and sculpture, and architecture at the same time. France and England furnish abundant instances of the same argument, viz., that these three fine arts are so many dialects of the same language, which expresses the laws and the effects of unity, variety and harmony of contours and proportions in works of architecture at the same time."

The partizans of the scientific and the imaginative have ever been in rivalry. But the evidences of history will prove the necessity of both these faculties in the accomplished architect, and it is to the cultivation of them that the Institute will direct their impartial attention in due proportion for the glory of the art and of the country.

Hitherto we had looked to the Royal Academy, the Government Schools of Design, and more recently the Museums at Kensington, established by the zeal and liberality of the Prince Consort, the British Museum, and the two Colleges of the London University, for those means which they command and offer for our benefit. We hope to form schools of our own, together with those advantages, and to offer higher collegiate grades, which would reward eminence, and recommend by certificates to the public patronage. These last, already established, in the shape of diplomas, in the Colleges of Law and Physic, and every learned society of the present day, proved the advantage of their being also adopted no less in the Institute of British Architects.

These contemplations might persuade us that we were but at the commencement of our success, and other reflections might add to this conviction.

Our funds being of our own creation were necessarily too moderate to embark in such increased means of instruction and usefulness as we had long contemplated, but the time was now approaching for the enlargement of those means to this effect.

The Institute could never doubt the protection of the public to such efforts as they had made, and the accession to those means which public and private encouragement superadded at all times to honourable efforts.

He exhorted them to continue their zeal and devotion to the advancement of their art, and the good of society, and to suffer no doubt to check or discourage the honest labours of which they might be justly proud.

A FEW OBSERVATIONS ON THE MODELS FOR THE WELLINGTON MONUMENT LENT TO THE INSTITUTE BY THE GOVERNMENT.

By F. C. Penrose, Hon. Secretary for Foreign Correspondence. Read at the Royal Institute of British Architects, April 23, 1860.

It appears desirable to preface a few remarks which I have been invited to make on the designs for the Wellington monument with a short account of the progress of monumental designs from antiquity down to the present time. We may leave out of consideration the colossal structures of Egypt and other oriental examples, and commence with observing that the monumental designs of the Greeks were of an architectural character. The mausoleum of Halicarnassus is well known to us, and has attracted great attention since the revival of classical architecture. Sir Christopher Wren endeavoured to recover its form from the descriptions of ancient writers alone, and our excellent President, with the further assistance of materials from the Mausoleum itself, has suggested a restoration in a form not very different from that of his great predecessor. The subject, however, still admits of much doubt, and I do not wish to enter upon it now, further than to observe that it was decidedly of an architectural character; the sculpture not usurping the *general* outline.

The humbler monumental memorials of Greece were usually of the well known stele form, not altogether unlike a plain early gothic headstone. The Romans also followed the Greeks in giving an architectural character to their tombs; witness a beautiful tomb at St. Remi, near Arles, and another at Igel near Treves, which are in very perfect preservation. In the East there are also rock cut tombs of the Roman times at Petra and elsewhere, all thoroughly architectural in their character. In the smaller tombs the Romans generally adopted the form of an altar, and not the Greek 'stele.' This architectural character of antique tombs was followed by the Byzantines and Normans (witness especially the fine altar tombs of the Norman Kings of Sicily, &c. in the Cathedral of Palermo) and transmitted to the Gothic period. In England we have many very fine tombs in our Cathedrals and Abbeys, in none finer than in Westminster. But of the tombs which I have seen of that period, the finest decidedly appeared to be the Royal tombs at Naples, especially in the churches of St. Chiara and St. Giovanni dei Carbonari. The architecture is predominant in the outline, and the sculpture in all these is exceedingly grand in character and well executed. There is no attempt at violent action; everything is calm. This air of quiet seems to be of the greatest consequence in a monument designed for a religious building. In one of the most important of those I am speaking of, one in S. Giov. die Carbonari, the principal personage is seated, surrounded, not by allegorical representations, invariably devoid of interest, and which (though perhaps sometimes in subordinate situations permissable) should rarely be relied on for a principal part of the effect, but, instead of the cardinal virtues or such other abstract imaginations, most difficult for the sculptor to realize, the principal figure is supported by seated figures of certain saints whose lives and virtues may be supposed to have been peculiarly the models of the character of the deceased. In another in S. Chiara the principal figure is recumbent, not deathlike or emaciated, (which is a vulgar and debased art) but as it were sleeping the sleep of death imbued with the consciousness of immortality. Two angels nobly conceived and executed, one at the head, another near the feet, hold back a curtain and disclose the quiet figure. On the back ground are represented groups of the attendants as in the act of retiring from the funeral. In another part of the same tomb the principal personage is represented in relievo seated and

receiving homage. All is in repose and well balanced, no figure stands by itself abruptly, but is harmonized, (without losing individuality) by the architectural accompaniment.

Similar criticism will apply to the grand monuments of the Renaissance and the more thoroughly classical works of Sansovino and others of the same period. I have brought sketches of a few designs of this period, one the famous Vendramini tomb in S. Giovanni e Paolo at Venice by the Lombardi. In this the deceased Doge lies attended by two angels. On the sarcophagus are small portrait figures of the members of his family. Within the arch in mosaic is a scriptural subject, on the spandrils a fine representation of the Annunciation, and in the two niches on each side originally were Adam and Eve, but these two figures have been removed. The contrasted idea of the first Adam with that of the second Adam, implied in the Annunciation, contains all that allegory could have suggested of mortal and immortal, and with far greater interest, because of their common relation to ourselves and the deceased. On two pedestals just *outside* the monument on each side were figures of two warriors, suggestive of the military prowess of the doge. These, since the removal of the figures of Adam and Eve, have been placed in the niches, and true figures of Saints placed on the pedestals. It must have been better to have followed more closely the original idea. Besides the larger figures, the composition is enriched with arabesques and heraldry, (the latter in due moderation) and the whole seems to be one of the most beautiful monumental designs ever made. In the same church are many fine tombs: that of Doge Giovanni Mocenigo, although not so rich as that of Andrea Vendramini just described, has much of the same excellence, and is probably by the same hand.

Another of my specimens is from a fine tomb, well designed by the great architect Baldassare Peruzzi, but of greatly inferior execution to those last described. It is to Pope Adrian VI, in the church of St. Maria del Anima at Rome.

The Pope is represented reclining on a rich sarcophagus, but not recumbent. Below on a podium a small figure of the Pope is placed on horseback, receiving the adoration of his people. The attendant figures on each side are in niches. Coloured marbles are used to some extent, but not so as to interfere with the sculpture. In the above the architect and sculptor go hand in hand, neither in any way usurping the province of the other. Where this usurpation does take place, either poverty, from the absence of sculpture, or an exuberant vulgarity of form from the absence of the correction of the architectural element, will be almost invariably the result. There may be, however, great works in which, according to the feeling of the artist, one or the other element is in preponderance, as in the beautiful works of San Michele, (one of whose designs is shown,—the monument to Tomasso Vico at Verona) in which generally but little sculpture is introduced. In this design only a bust. In the works of San Michele, however, the sculpture is always well executed. In this particular the works of Palladio are much inferior to his. In the monumental works of another, and greater master, Michael Angelo, the sculptural element preponderates over the architectural. Yet who can behold unmoved, the "Penseroso" monument at Florence, or that sublimest work since Phidias, the Moses in St. Pietro in Vincoli. In Michael Angelo's works the architectural element, although not by any means forgotten, was subordinate, so that the "stupid imitators" as Milezia calls them, of that extraordinary man, like the frog in the fable trying to puff itself to the size of the bull, and bursting in the fruitless attempt, seem to have thought that the architectural element could be dispensed with altogether, and I am inclined to derive from this source the kind of block monument as we may call it, which has been so much the fashion, to the sad disfigurement of many of our fine public buildings, especially Westminster Abbey and St. Paul's. Exactly when it took root in England I am not prepared to say; not before the eighteenth century was some little way advanced, I should gather from a monument by Gibbons, in which the architecture is well balanced with the sculpture; and also

from one by Gibbs in Westminster Abbey, in the north transept, to Lord and Lady Holles. However, the block monument soon prevailed to such an extent, that for a great many years nothing else could be thought of, and chiefly for the reason that architects knew nothing of sculpture, and sculptors as little of architecture. Our honoured and excellent President has already spoken of the importance of a union of these arts, and quoted the names of great men who have been distinguished alike in architecture and sculpture: he omitted, however, the name of an architect-sculptor, which we shall have no difficulty in supplying; the discoverer of the sculptures of Ægina and Bassæ, and sculptor of the tympanum of St. George's Hall at Liverpool.

I have thus endeavoured to lead your attention to some of the works of established merit of the best periods of taste, during the complete union of sculpture and architecture down to a period when these arts became disunited, and a species of monumental sculpture was introduced which, whatever may be the merit of individual figures, wants the solemnity and repose befitting a place of worship—introduces a great number of figures, ill balanced and crowded together from want of the architectural framework—has a great tendency to unmeaning and uninteresting allegory, occupies generally available space, without even allowing the eye to penetrate—choosing for the most part exhibitions of violent action, greatly discordant with a religious edifice; sacrificing the advantage of the contrast that may be obtained between the free lines of the sculpture and the measured rythm of the architecture—having often a scale of dimension for the figures unfortunately large; and with the architectural mouldings, where introduced, for the most part discordant with the architecture of the building in which the monument may be placed.

If we thus make comparison between the two kinds of monument to which I have called your attention, we cannot fail to admit the importance of a union of sculpture and architecture; and we may draw the conclusion that it behoves us as architects, and especially the younger members who have time before them, to make ourselves acquainted with drawing the figure, not only on account of the first-rate training to the eye obtained from that study, but that we ourselves, in designing sepulchral monuments, or in co-operating with sculptors so engaged, may force the proper dignity of our art to be recognized.

Of the designs exhibited in Westminster Hall by far the greater number were of the kind I have called block monuments; but a few were architecturally treated. Ten designs received premiums, and of these nine have been sent here by the kindness of the Chief Commissioners of Her Majesty's Works, &c.; of these nine are of the block character. The design of Mr. Alfred Stevens, which was selected for execution by the Chief Commissioner under the late Government, is of an architectural character, combined on equal terms with sculpture. The model is not here, as it is required by the artist.

Its general form may be shortly described as a recumbent figure on a sarcophagus, surmounted by a rich canopy, which canopy is supported by twelve Corinthian columns. Before being finally executed in the intended permanent materials (marble and bronze), a full-sized model is intended to be erected on the site proposed for it, namely, the chapel on the south side of the cathedral, near the west end, which was used in times past for the Bishop's Consistory Court. The two sculptors who received the first premiums, viz. Mr. W. Calder Marshall, and Mr. Woodington, have been commissioned to execute, in marble, bas-reliefs in the panels, which are on the east and west apses of the chapel. The subjects of the bas-reliefs are taken from Scripture, having a reference to the character of the great Duke, following out in this as much as possible the advice given by the Poet Laureat:—

"We revere and we refrain
From talk of battles loud and vain,
And brawling memories all too free
For such a wise humility
As befits a solemn fane," &c.

I have every hope and expectation that these artists will all do justice to the important and national work on which they are engaged, but it will necessarily take a very considerable time before the works can be in a state of sufficient forwardness for the members of the Institute to be invited to inspect them.

Mr. C. Barry (Fellow) begged to tender the best thanks of the meeting to Mr. Penrose for drawing their attention to a subject which, in its general aspect, every one must feel possessed great interest; and for the special reference to the important monument which had occupied his chief attention. It occurred to him that possibly the so-called failure of the competition for the Wellington Monument (for it was considered to a great extent a failure) was perhaps to be attributed to the very great difficulty of uniting the idea of a monument with that of a tomb; the sentiment to be conveyed by each being very different. The artists had thus, in several cases, failed in realizing either of these ideas, by attempting to realize both. The lesson of mortality conveyed by a tomb was, that all men were in the same position in the grave; and this idea admitted of no glorification, nor of any representation of the deeds of him whose memory was recorded. Least of all should the tomb present a figure of the deceased as he was in life. On the other hand, a monument was expressly intended to perpetuate the remembrance of the great deeds of the person who had passed away, and to excite a spirit of imitation and emulation among the living.

The vote of thanks to Mr. Penrose was unanimously carried, and the meeting adjourned.

ON THE ARCHITECTURAL CAREER OF THE LATE SIR CHARLES BARRY.

By M. Digby Wyatt, V.P. Read at the Royal Institute of British Architects, May 21st, 1860.

No one can be more sensible than I am of the extreme difficulty attendant on the satisfactory discharge of the duty which has been imposed upon me this evening by our sincerely respected President; a difficulty enhanced in no slight degree by three circumstances—the shortness of the time in which the following remarks have had to be prepared, the ability and manly feeling with which the *Builder* has already put you in possession of many facts, some of which must be recapitulated in any memoir of our distinguished and lamented friend, and last, not least, my own inadequacy to so great and so touching an occasion. Who, gentlemen, could dare, but in a spirit of almost paralysing reverence, to pronounce a funeral oration upon the architect of St. Paul's? And who amongst us will feel inclined to deny that the architect of the New Palace at Westminster is worthy of an equal tribute of respect and regard at the hands of those who, having known and admired him living, have now only to mourn and venerate him dead? Praying your indulgence, therefore, for any involuntary shortcomings, I shall proceed to address myself, after a few preliminary observations, to the story, and, as far as I am able, to the moral, of the architectural career of the late Sir Charles Barry.

Of such men it is occasionally said, that they cannot be rightly appreciated in their own generation, and that it is not until intervening time may have, as it were, permitted "the mind's eye" to recede sufficiently to be enabled to embrace generalities, and to blend them according to proper pictorial conditions, that the relations of such men to the circumstances by which they may have been surrounded can be justly estimated. Of the philosopher, legist, politician, and of the hero who dominates in the feverish turmoil of class against class, or nation against nation, this observation may frequently hold good; but of the great artist, comparatively rarely. His creations are of an essentially monumental character, and it has scarcely ever occurred that the author of works commonly known at the date of their execution, and ultimately accepted by the universal verdict of posterity, has failed to be recognised by his own generation, and certainly by cotemporaries in his own profession, at his approximate value. There is, in fact, no more distinctive and vital characteristic of true art than its universality. Really creative power is neither for this time nor for that class, but for all time and for all classes—for the present as for the future, and for the future as for the present. The poet, the painter, the sculptor, the musician, the architect, appeal in their highest efforts to sympathies, aggregate as well as individual. From this inherent condition of universality in all great works of art emanate three especial bonds of union and affection:—Firstly, between genius and the world at large; secondly, between genius and all who, however devoid of it, may be endeavouring to achieve success in the same department of art; and, thirdly, between genius and kindred spirits of all ages, who, in pursuits of the most widely differing natures, have reared their heads aloft above the average of mortality, and won admission to that noble brotherhood whose very names have become landmarks in the history of civilization. In the death of every great artist these bonds receive a sudden shock, which, however it may jar and strain, can never break them. There can be no higher tribute to the ascendancy of genius than this impotence of death itself to finally sever bonds of union between mind and mind which it can only shatter, and it is the very measure of this impotence which affords the best scale for ascertaining the nature, force, and amount of the loftiest order of human creative power.

Let us for a moment apply it to the case of the friend we have lost, and try his memory by the three bonds described, as at once the essential tests, concomitants, and rewards of genius, contra-distinguished from mere talent, industry, and experience.

In the first place, then, can the world at large cease to esteem the designer of the Houses of Parliament, the Reform and Travellers' Clubs, Bridgewater House, Cliefden, or Trentham? Surely to this the only answer can be,—Yes, when they have forgotten Sir Christopher Wren and Inigo Jones, Bramante, Claude Perrault, and Palladio; and not till then. In the second place, can we, as architects, or can they who may succeed us when we shall rest from our labours, as our friend now rests from his, cease to regard with interest and admiration the models for study bequeathed to our art in monuments such as those, on the production and perfection of which his most strenuous efforts were concentrated? Surely never so long as architecture remains a fine art, based on any recognised laws of symmetry, eurythmia, fitness, and proportion, can we fail to appreciate works in which (whether under a more or less classical or mediæval garb) the true importance and, indeed, indispensability of a rigid but at the same time free subordination to those laws, are more ably vindicated than (according to my belief) in the works of any other architect who has lived for at least two centuries?

Can, in the third place, Sir Charles Barry be refused admission to that fraternity figured in the immortal school of Athens by the immortal Raffaele? Most assuredly not. There, as in the sanctuary of the illustrious dead in which his remains will be deposited to-morrow, a place may be clearly retained for him; and whenever Wren, and Jones, Vignola, Peruzzi, Palladio, Sansovino, San Michele, and others whose title is undisputed, join that group in which Bramante and Archimedes are all conspicuous, Barry and Visconti, Schinkel, and Von Klenze (when he shall be taken from us), may find their places as no unworthy representatives of the architectural genius of the nineteenth century.

Tried by such tests, by the minutest study of his works, their number, excellence, importance, novelty, fitness, and promise of stability for ages, and by the influence exerted through his example upon the current practice of his art, Sir Charles Barry may, by no hyperbolic straining, be classed with Wren and Jones, with Wykeham and with Waynflete. Let us now trace, far too briefly, the steps of conscientious labour by which this glorious and enduring pre-eminence was attained.

Charles Barry was born on the 23rd of May, 1795, of parents in a comfortable position in life, and resident in Bridge Street, Westminster. From mere boyhood he displayed and indulged a marked talent for drawing; and I have been told that it was his habit to sketch all over the walls of the bed-room in which he slept. When no more space was left he would paste lining-paper over the surface he had covered with scribblings of his fancies, and start afresh upon a new series. The first part of his education Barry received at Mr. Wright's academy—now Mr. Beaufoy's—Carron House, South Lambeth, where he was at school as early as 1804; the latter part he gained at Christ's Hospital. At the age of sixteen he was articled to Messrs. Middleton and Bailey, respectable surveyors to the parish of Lambeth, with whom he appears to have remained about five years. One of these gentlemen at least must have been able to give his pupil artistic instruction, for I observe the name of Mr. Bailey, of Lambeth, appended to several designs in the exhibition of an ambitious character, such as "For a National Museum and Cemetery," &c., during the term for which his apprentice had been bound to him.

Barry must have been a tolerable draughtsman at the time of his entry into his master's office, for so early as 1812, before he was seventeen years old, he was admitted as an exhibitor at the Royal Academy; and, singularly enough, his first exhibited drawing was "A View of the Interior of Westminster Hall," the very building which, as it were, served as the key-note to his greatest work in after years. It appears in the catalogue of 1812 as the production of "C. Barry, at Messrs. Middleton and

Bailey's, Lambeth." It was on his way from his father's house to the office in which he worked that the young student met every day another young lad *en route* from Kennington, where he resided, to the chambers of Mr. Joseph Gwilt, to whom he was articled. That young lad was the Mr. Wolfe whose friendship and intimate sympathy proved in after-life a permanent source of pleasure and comfort in all the most trying epochs of Sir Charles's career. The two youths soon made acquaintance, and subsequently mutually aided one another in the studies, on their proficiency in which they supposed that their future advancement would depend. Mr. Wolfe, it is well known, was induced to abandon the pursuit of his profession for more immediately lucrative occupation; but the divergence of their paths in life never chilled the mutual regard of these two enthusiastic young students. In 1813 "C. Barry" made his *début* at the Royal Academy with an original design, "for a church." In the following year his contribution is of a still more ambitious nature, being for no less a monument than "a Museum and Library, with an Observatory." In 1815 he re-appears, still giving his address "At Messrs. Bailey and Middleton's, Lambeth," with a more practical effort in the shape of "A Design for a Group of Buildings for a Nobleman's Park, comprising a Picture-gallery, Library, Music-room, Conservatory, and Billiard-room." In the following year, to the best of my belief, several events happened which suffice to account for his absence from the Exhibition of 1816. His articles expired, he fell in love with the lady whom he subsequently married, and his father died. All of these circumstances, coupled with the fact of his coming into the immediate possession of a few hundred pounds, caused him to resolve upon, and to carry out, against the advice of all his family, a bold step, on the indispensability of which to the attainment of that excellence upon the acquisition of which he had firmly set his heart, he had fully made up his mind.

In April, 1817, he accordingly quitted England, in the company of a Mr. Conduitt, with whom he travelled for some time: Wolfe subsequently joined him, and for some months they worked hard in Northern Italy, drawing and measuring, at Florence and elsewhere, with the utmost zeal and perseverance. At Rome he met Eastlake, and other artist friends, whom he always highly esteemed. With Mr. Eastlake, Mr. Kinnaird (the editor of "Stuart's Athens"), and Mr. Johnson—subsequently Professor Johnson, of Haileybury College—he visited Greece in 1818, and made many beautiful drawings. One of these, "A View of the West Front of the Parthenon, taken on the spot," he sent to Somerset House in 1821. Another, "A View of the Temple of Theseus, at Athens, drawn and tinted on the spot in the year 1818," appeared in the exhibition of 1823. He returned to Rome with his portfolios full, but with his pockets so empty, that, despite his earnest desire to go further a-field, he was on the very point of starting homewards, when he happily made the acquaintance of a gentleman of fortune, a Mr. Baillie, who was so pleased with his sketches, that he made him an offer of an engagement as travelling artist. With that gentleman, in 1818 and 1819, young Barry went up the Nile several times, and visited the Holy Land, making beautiful sketches of the principal localities, from some of which engravings were subsequently executed for Finden's landscape illustrations of the Bible. "A View of a Street in Grand Cairo, from a sketch taken on the spot in the year 1818," exhibited in 1824, was one of the fruits of these happy wanderings. At Sinai he met Mr. William Bankes (son of the well-known Mr. Bankes, of Corfe Castle), in whom he found an accomplished acquaintance and a liberal patron. A memorial of this association may be traced in the exhibition catalogue of 1822, when Barry contributed a drawing of "the Scene of a Roman Theatre at D'Jerash (a great part of which actually exists), restored principally from documents collected on the spot, by William Henry Bankes, Esq." He remained with Mr. Baillie for about a year and a half, and returned to England in July 1820. During the whole of his wanderings he kept an admirable journal, which, it is to be hoped, may be some day given to the world. In that same year, 1820, he established himself in business at 39, Ely-place,

and, I believe, married Miss Rowsell, to whom he had engaged himself before leaving England. In the catalogue of the exhibition of 1821—to which he forwarded a picture of "Ruins of the Great Temple of Egyptian Thebes, the view taken on the spot in the year 1819"—his address is given at his recently occupied abode. I am unable to trace his first architectural employment, and can identify nothing earlier than the Manchester Church, which he appears to have been employed to design in 1822. A drawing of it, described as "now building," was in the exhibition of 1823, together with the "west elevation of a design for a Church to be built at Oldham." About the same period he built another church in the same district at Stand. In 1823 he competed for, in public competition, and obtained employment as architect to, the new church of St. Peter's, at Brighton. Two views of it, as "now building," were sent to Somerset House in 1824. In many respects this church was superior to any contemporary ecclesiastical work, and its popularity greatly enhanced that of its designer. It certainly led to his first aristocratic connection, for it induced Lord Egremont to employ him to add a steeple to the parish church at Petworth, a sketch of which was exhibited in 1827; and to make several designs for alterations, &c. to his seat at Petworth. A drawing of a spire it was proposed to add to the Brighton Church was exhibited in 1826, together with a front view of the "Royal Institution for the Fine Arts now building at Manchester." About this time Barry appears to have been a good deal employed at Brighton, in laying out the Queen's Park, building a house for a Mr. Attree; and another (Clarence Mansion, since much altered, but not by him) of a good Italian character, looking over the sea, has been pointed out to me on the spot as one of his early works. Many of my hearers will doubtless remember a brilliant lithograph, by our Fellow, Mr. T. Allom, showing Barry's original intentions with respect to the Queen's Park, Brighton. He also built the Sussex County Hospital. The Manchester Royal Institution, and a house which he erected about the same time for Mr., afterwards Sir Thomas, Potter, at Buile Hill, near that city, were in that Anglo-Grecian style which Sir Robert Smirke had mainly popularised; but from which, despite fashion, Barry took the earliest possible opportunity of emancipating himself. His success (for such it assuredly was at the date of its execution) with the Brighton church led to his engagement to design a group of churches proposed to be executed by the Church Commissioners, under a strong stimulus from the late Daniel Wilson, in the parish of Islington. The three carried out by Barry were, respectively, St. John's, Holloway, perpendicular, with a tower, to hold 1,782 persons, at a cost of £11,809.; Balls Pond, a very similar building, to hold 1,793 persons, at a cost of £10,947.; and Trinity Church, Cloudesley-square, a larger but corresponding structure, to hold 2,009 persons, at a cost of £11,535. Of this last a curious little aqua-tint engraving, an early work of the afterwards well-known architectural draughtsman, is extant, "published by G. Hawkins, near the Grove, Hackney, on the 1st May, 1826," at which date the church would appear to have been recently completed. At a subsequent date Barry built another church in the Islington district, the funds for which were provided by the Commissioners of Queen Anne's Bounty, that of St. Peter's, River-lane, Islington. This building, which cost only £3,407. 2s. 7d., in the days of the cheapest and worst churches, was consecrated on the 14th of July, 1835. In order to complete here the summary of Barry's ecclesiastical works, I may mention that to the best of my belief he was only engaged during his career upon three other churches;—the parish church of Stoke Newington, which he almost entirely rebuilt and refitted; one at Hurstpierpoint, in Sussex; and another, St. Andrew's, on Saffron-hill, Holborn, with a turret and vaults, to contain 1,783 persons, at a cost of £9,004. All of these, with the exception of Hurstpierpoint, which is Middle-pointed, were, I believe, in the Perpendicular style, and were rather above than below the average work of the best men of the day, who were beginning to make Gothic a somewhat special and exclusive study. His Unitarian chapel at Manchester, the design for which he exhibited in 1840, at which date it was, I believe, completed,

was his only attempt in the first Pointed style, and attracted considerable notice at the date of its execution.

Soon after his establishment in business, Barry obtained the appointment of architect to Dulwich College, and was soon employed to erect a new wing to that building; he also became in some way connected, I believe about the same time, with the construction of a new wing to St. Thomas's Hospital.

In 1827, Barry's increasing business and connection justified his removal westwards, and we accordingly find him leaving 39, Ely, for 27, Foley-place. Among the most important of the studies made in that year was a design, which was approved of by Lord Gwydir, for the rebuilding of Drummond Castle, Perthshire, two views of which were exhibited in 1828. In 1829 he designed, but did not carry out, various additions to the Pitt Press at Cambridge, and struck at last upon the golden vein which ultimately made him a prosperous man. In the designs for the Travellers' Club, which were submitted in limited competition, Barry first revealed his resources in planning, and that refined perception of just proportion, both in detail and general distribution, in which he has scarcely ever been rivalled. The garden front is, so far as my knowledge extends, an absolutely original conception; and as such may, I consider, take its place in the history of art. The Pall Mall front has been frequently characterized by superficial observers, as a copy, or reproduction, with slight modifications, from Raffaelle's Pandolfini Palace at Florence. One moment's comparison of the two elevations will suffice to entirely dispel the idea. The Pandolfini Palace has only, in common with the Travellers' Club-house, the accidents of being two-storied, having rusticated angles, and a door-way at the extreme right hand side of the ground-floor of its principal façade. In every other respect, the dissimilarities are most striking; the proportions of the windows are about one-third narrower in the Travellers' than they are in the Pandolfini; in the former, they are Ionic on the first-floor, and Doric on the ground; while in the latter, they are Corinthian on the first-floor, and have simply returned architraves and no order on the ground-floor. The four windows of the first-floor of the Florentine façade are surmounted with alternately angular and segmental pediments, and united by panels in the interspaces and by horizontal members, while the five of the Pall Mall building are precisely uniform, and the wall is entirely free from panelling, and the running through of any one of the members forming or decorating the fenestration above the cill level. One of the leading features of the Pandolfini is its deep plain frieze, adorned only with a very simple classic-looking inscription; while in the entablature of the Travellers' Club the frieze is reduced to so small a proportion and is so highly carved, as in fact to do duty rather as an enriched member of the cornice than as a distinctive frieze at all. As a corroboration of the remarks I have ventured to make in respect to the universality of genius, and the immediate effect upon the public, of any salient manifestation of it in the shape of a work of art, it may be noted that, from the date of its completion, in the year 1832, to the present time, no architectural Zoilus has ever raised his puny voice to the disparagement of this real gem. The contract was taken early in 1830, by Messrs. Lees, at £19,000., and the total cost was £23,160. On the completion of this beautiful structure, its architect was elected a life member of the club; a compliment, considering the very exclusive nature of its constitution, of no slight social and professional importance to a rising artist.

Pall Mall also possesses two ordinary house façades of great cleverness, executed by Barry, and the Imperial Insurance Offices, opposite to his great club-houses, and of about the same date as the Travellers'. While the last-named was in progress, he was subjected to three disappointments, one of which annoyed him a good deal. He became an unsuccessful competitor for the Westminster Hospital, carried out by Inwood; for the Law Institution, carried out by Vulliamy; and for the Birmingham Town-hall, entrusted, as is well known, to Messrs. Hansom and Welsh, under very peculiar circumstances. In response to the advertisement issued at the close of 1830, calling for designs for the last-

named building, Barry forwarded a noble scheme for a Doric temple of grandeur, and at the same time of so much simplicity, that his friends confidently averred that it might be carried out well for the £18,000., which formed the limit fixed by the committee. Barry's plan was so long placed in the ascendant, that he confidently reckoned on being employed to execute it. From first, however, it somehow sank down to third, and a design was at last adopted, which, after utterly ruining the contractors, cost the Corporation nearly double the amount to which they at first limited the outlay. Barry exhibited his design, which was much admired, in 1832. From that year his occupation appears to have been so incessant as to preclude his contributing to the Royal Academy, and it is not until 1840 that he reappears in the architectural room. Nothing daunted by his bad luck with the town-hall, Barry sent in designs (for the preparation of which two months only had been allowed) on the 1st of November, 1832, for the Free Grammar School, commonly known as King Edward's, at Birmingham, which he won easily. This popular building, with its seven regular bays, and bay windows breaking through two stories at each end, was most carefully carried out in every detail, and in a good collegiate style, in that most beautiful building stone, Darley Dale, and gave great satisfaction. It was completed in 1837, at a cost of £39,263. The study bestowed by Barry upon the working out of this building, and consequently upon the Tudor style generally, he found of the greatest possible service to him when subsequently called upon for the Houses of Parliament competition. It was about the period of the completion of the Birmingham schools that Barry became acquainted with Welby Pugin, whose talents he always greatly admired. Pugin was selected, and employed to work out the drawings from Barry's sketches for some of the ornamental details, and for the furniture of the building, and thus the foundation of their mutual regard and respect for one another's powers was laid.

1834 was an eventful year for our profession, and especially for that member of it whose career I am now endeavouring to trace, since on the 16th of October in it took place that memorable fire which rendered the reconstruction of our national assembly a positive necessity. That event occurred at a time when Barry was closely occupied upon several works of importance, in addition to those already mentioned, such as various constructions at Bowood, for Lord Lansdowne; the Campanile, Lodge, and Golden Gates, being in progress so late as in 1838; the portico and enlargement of the College of Surgeons, which was sufficiently advanced to show the general character of its design in February, 1835, and was finished in 1837; Lord Tankerville's beautiful Italian villa at Walton-on-Thames; and various alterations at Woburn for the Duke of Bedford. He had also been called in by the Marquis and Marchioness of Stafford, who had been first impressed with his talent for picturesque gardening, by the terraces and other features which they had remarked at a *féte* given in the Queen's Park, Brighton. The architect was introduced to these leaders of taste at the time by Mr. Attree, for whom he had laid out the grounds in which the *féte* was given, and was subsequently employed, at first, in trifles such as vases, flowerpots, and ornamental details; but ultimately, in vast works at Trentham, Stafford House, and Cliefden, so late as 1853, as well as in great designs for Dunrobin Castle.

In 1833, the extensive designs for the conversion of Trentham, an ugly house in a flat and uncongenial soil, into what that princely seat now is, were made. No one could be a better judge than the late Mr. Loudon of the local difficulties presenting themselves to the architect and landscape gardener, and I prefer, therefore, quoting him to making any comments of my own. He thus (writing in May, 1834) records his impression of the daring and talent evinced by the artist architect:—

"Trentham Hall, the residence of the Duke of Sutherland, is about to undergo extensive improvements. When we first heard of this, and that Mr. Barry was employed, we could not help doubting whether even Mr. Barry could make anything of this great, dull flat place, with its immense mansion, as tame and spiritless as the ground on which it stands. We have seen the plans, however, for the

additions to and alterations of the house, and we must confess that we were delighted and astonished with them beyond measure. Let no one henceforth ever despair of a dead flat. We shall not attempt to describe the additions made to the house at present; but we may observe that the modifications of the ground, and the large lake of water and its islands, which are proposed by Mr. Barry, prove him to have as just a taste in landscape gardening as he has a refined and correct one in architecture. The architectural flower-garden, which will contain several acres, will be the largest and the best of the kind in England. On one of the islands a villa with terraces, in the manner of the Isola Bella, will be erected, as a feature to be seen from the house over the architectural garden; and a column now erecting on a distant hill will form another feature. The fountains of the garden, which will throw their waters as high as those at Chatsworth, Versailles, or Nymphenburg, will be supplied by a steam-engine, or by a water-wheel on a distant stream; and no garden beauty will have a more striking effect in Staffordshire than this feature."

Barry's employment in realizing the greater part of this vast programme extended over about ten years. By way of current business in 1836, he had also in hand the Manchester Athenæum, a well worked out but simple Italian building, costing about £15,000. We now approach the great event in Barry's life—the competition for the New Houses of Parliament.

On October the 16th, 1834, as I have already stated, the conflagration took place, and shortly afterwards Sir Robert Smirke was employed by the Department of Works to make plans, &c., for the rebuilding. Sir Robert Peel, always a kind patron to Sir Robert Smirke, appointed a committee to examine his designs. The committee publicly acknowledged themselves unable to form a sufficiently accurate judgment upon the merits of any plan, but recommended open competition and the appointment of a Royal Commission, which was accordingly applied for.

To this course, so far as the appointment of a commission of five is concerned, they were no doubt mainly instigated by Sir Edward Cust's celebrated letter to Sir Robert Peel, dated January 31st, 1835. Sir Edward was, however, averse to the principle of competition in the matter, he would have intrusted the selection of the architect to the commission he suggested. The style of the proposed building it was determined by Parliament should be either Gothic or Elizabethan.

On the 17th July, 1835, the country obtained from the King the issue of a Royal Commission to fix the site and obtain designs for new Houses of Parliament. The terms of the Royal Commission provided for a selection of not less than three, nor more than five designs, all of which were to be reported to Parliament, and one of the three or five to be definitively recommended for adoption. The acting commissioners were the late Mr. Hanbury Tracy, afterwards Lord Sudeley, Sir Edward Cust, Thomas Liddell, Esq., and George Vivian, Esq., Lord Duncannon being at the time First Commissioner of her Majesty's Woods and Works. Ninety-seven designs, comprising upwards of 1000 drawings, were contributed in competition for three or five premiums of £500. each, and after a private view for the members of both houses, &c., and the confirmation by a Parliamentary Committee of the report of the Royal Commissioners, were publicly exhibited from the 28th of April. The Royal Commissioners state in that document, approved by his Majesty, and presented to both Houses of Parliament, on the 29th of February, 1836, that "although a difference of opinion may exist between us with respect to the ground plans separately considered, we are all unanimous in our opinion that the one delivered to us, marked 64, with the emblem of a portcullis, bears throughout such evident marks of genius and superiority of talent, as fully to entitle it to the preference we have given it in our classification; and we have no hesitation in giving it as our opinion, that the elevations are of an order so superior, and display so much taste and knowledge of Gothic architecture, as to leave no doubt whatever in our minds of the author's ability to carry into effect your Majesty's commands, should you be pleased to honour him with

your commands." The design thus recommended, proved to be the one drawn, to a great extent, by the very hands of the late Sir Charles. It is not generally known, but it is nevertheless the case, that Barry entertained a predilection in favour of an Italian style for the Houses of Parliament, and went so far, in despite of the formal prescription, as to prepare sketches and studies, some of which are still in existence. The second premium was awarded to Mr. Buckler, the third to Mr. Hamilton, and a fourth to Mr. Railton. It was not from these rivals, however, that the most strenuous efforts subsequently made to wrest away the precious prize from the victor emanated. The battle of the styles appears to have been opened by the late Mr. W. R. Hamilton's first letter to the Earl of Elgin (July, 1836), recommending Greek, and its disciples, Sir Robert Smirke and Mr. Wilkins. Mr. Hamilton's letter was followed by a second in the same year, in February, 1837, and an article on Barry's designs in the "London and Westminster Review." These were replied to ably by Colonel J. R. Jackson, who supported Gothic on the plea mainly of nationality. Mr. Hamilton's views were endorsed by Mr. Wilkins (under the pseudonym "Phil-Archimedes"), Mr. Grellier, and Mr. A. W. Hakewill; and Colonel Jackson's were anticipated by Welby Pugin and Benjamin Ferrey, who, with T. L. Donaldson, stood up honourably in favour of the execution in its integrity of the selected design, with none of the petty jealousies displayed by Savage, Hopper, Cottingham, Wilkins, and others. Acrimonious pamphlets, in the shape of "observations, apologies, strictures," &c., were freely bandied about. Accusations of favouritism were made against Sir Edward Cust, on the plea of his having been concerned in assisting in the production, a year or two previous to the competition, of a curious little etching by Barry, now very rare, showing the defects of the lowness of Wilkins's designs for the National Gallery and the effects of a loftier structure. That somewhat satirical performance had offended Wilkins, who had previously come off victorious in a competition for the works at King's College, Cambridge, for which Barry had sent in; and its execution may account for the sharp stings of Wilkins's very pointed pen.

It is curious in looking over these old controversial wranglings between Goth and Greek, to note how little we have changed. The battle, unfortunately, still wages amongst us at the present moment, and we are obliged to confess that the spitefulness of yesterday, and of many a yesterday, is but a version, with scarcely a variation, of the spitefulness of to-day.

All these hot agitations and heartburnings, coupled with the proverbially feeble administration of the Department of Works, and the slow and desultory action of Parliamentary Committees, retarded, more even than the physical difficulties to be overcome, the commencement of the works. Cotemporary protests against all this *friction* were by no means wanting, and the following, from the pen of Mr. Bartholomew, is among the most animated, and evinces a just appreciation of the powers of the architect, and the difficulties which lay in his path:—"The nation may take this pleasing assurance," he observes, "that, confided to Mr. Barry, a senate-house worthy of the empire will be produced, with every detail correct, not only in the principal parts of the pile, but also in the most retired parts of it. This excellent architect is rarely found straying from his subject; he studied it like a Freemason of the olden times. The nation should, therefore, second liberally his generous efforts; it would afterwards be very proud of them: it should allow him to *build indeed* substantially, with granite, with Portland stone, and with oak; it should deny him no proper ornaments; they cost comparatively little, and if denied now, regret will be felt hereafter."

In the interval which elapsed between the acceptance of his plan and the laying of the first stone, which took place on the 27th of April, 1840, Barry was, as we shall now see, by no means idle. In addition to the preparation of the vast quantity of designs and working drawings necessary for entering into contracts for the Houses of Parliament, and for carrying on the works he had in hand before the competition, he proceeded, in 1837, to enter actively into the limited competition for the Reform Club, to which

Messrs. Basevi, Blore, Smirke, Burton, Cockerell, and he himself, had been invited. On Wednesday, the 13th of December, in that year, the committee proceeded almost unanimously to fix upon his design, which was ultimately carried out at a cost of about £80,000. This noble building is so completely patent to every Londoner, and its merits are so universally acknowledged, that I shall offer remarks upon three points only in connection with it. First, then, let me remind you of the entire originality of converting the usual cortile of the Italian palace into an internal and most beautiful hall; secondly, let me call your attention to the perfection of the domestic arrangements, which teaches us that the most minute attention to comfort, and the satisfactory working of utilitarian necessities, are compatible with the exercise of the most delicate sense of refinement, and the hardihood of bold and towering genius; thirdly, I would beg to vindicate the memory of Sir Charles Barry from a charge of plagiarism, to the full as absurd as that which has been grounded upon the fancied resemblance of the Pall Mall front of the Travellers' to the Strada Pandolfini front of Raffaelle's Florentine Palace. It has been alleged that the Reform Club in some degree finds its prototype in the Palazzo Farnese. Setting aside the utter non-conformity of any two features in their respective plans, let us for an instant compare their principal elevations: the one contains thirteen bays in width, the other nine; both are three-story buildings, with large crowning cornices, and there the resemblance ends. Every detail is absolutely different, and let me add that I do not think that Sir Charles Barry ever did or ever could copy; his whole system of working was opposed to anything of the kind. Should you ever have the opportunity of tracing out the progress of his thoughts, as I have frequently, and as no doubt all his pupils have, through any series of his studies for any particular building, you will find that the work is always, as it were, growing evenly under his hand, from the slightest generalization in the first small scale-sketch to the plotted-out bay or repeat, and subsequently to the large scale detail; then back again into another general elevation, to see how far that particular detail will work well in combination, then altered according to the result of that test, and roughed out again to a large scale, to make sure of the effect of the parts when near the eye; and so on frequently until his fastidious judgment would get almost bewildered under the multiplying and conflicting impressions produced by the various studies. The man who works in that way perseveringly may at least make sure of two things—that his work will be good, and that it will be his own.

Among the practical questions connected with the new Houses of Parliament, one of the most urgent was the selection of the stone; and as the mooting of that question led to the important survey by a commission in the year 1838, I may perhaps mention the immediate connection of Sir Charles with that movement. It appears from information with which I have been supplied by our kind friend Mr. C. H. Smith, the only surviving member of the commission, that, soon after the fire, Mr. Joubert, of Caen, sent specimens of Caen stone to about twenty different members of Parliament, and among others to Mr. Joseph Hume. Mr. Hume referred to Mr. Smith for a report, which was forwarded to the Department of Works, and by them to Mr. Barry, who at once wrote an admirable note to Mr. Hume, stating his views and his intention of making a tour throughout Great Britain to collect information. It was then arranged that scientific and practical men of eminence should go on the same errand with him, and the result was that, during fifty days in the autumn of 1838, the information was collected which has been embodied in the valuable report of the commissioners.

In 1840 Barry made fine designs, which were well carried out, for converting Highclere, a seat of Lord Carnarvon's, into an irregular version of Italian. About the same time he completed additions to University College, Oxford, and I believe made comprehensive designs for buildings at Worcester College, in the same city. In the year following the laying of the first stone of the Houses, Barry began to reap the honours he had so fairly won—being elected Associate in that spring; Associate elect

in 1842, and Royal Academician in Wilkie's place in 1844. His first recognition from abroad dates from Rome, Dec. 29th, 1842, conveying his affiliation to the Academy of St. Luke's; his second from St. Petersburg, Dec. 31, 1845. His election into the Russian Royal Academy, which was accompanied by the presentation of a diamond snuff-box from the Czar, was ultimately followed by his nomination to those of Belgium, 9th Jan. 1847; Prussia, 28th April, 1849; Sweden, 25th May, 1850; Denmark, Antwerp, and the American Institute. In 1855 he received the gold medal of honour for architecture, given at the Exposition Universelle of Paris, at which he acted as juror.

In 1841 Barry produced his noble design for Bridgewater House, for Lord Ellesmere, which was very different from that which he commenced as late as July, 1847. Probably no building he ever executed was more elaborately studied, and the result is shown in much of the beautiful detail which decorates the princely structure.

The first stone of the superstructure of the Houses of Parliament, the angle of the plinth of the Speaker's house nearest the bridge, was laid (as has been already stated on the 27th of April, 1840) by the architect's wife, without any public ceremony, and in the presence of a few personal friends only. The first stone of the Victoria Tower was also laid in the same unpretentious way by Lady then Mrs. Barry, on her own birthday, the 22nd of December, 1843.

From 1840 to 1843, the works at Westminster, to which neighbourhood (32, Great George-street) Barry had removed in 1841, proceeded at a splendid pace; but shortly after that date difficulties arose against which even his strength, industry, energy, and unrivalled dexterity in managing recalcitrant employers, failed to make successful head. The only wonder is he was not killed by incessant worries and annoyances. To these cares his son Edward alluded in the following terms, in the paper he read here on the 1st February, 1858, on his father's great work:—

"In the session of 1844, a committee of the House of Lords, which was appointed to inquire into the progress made with the works, in consequence of a natural desire on the part of their lordships to enter their new house, and a still more natural inclination to blame an architect for anything inconvenient, commenced its labours, and reported that several alterations had been introduced into the design by the architect, without any authority from the Government; an accusation he explicitly denied by stating that he had received authority, express or implied, for all he had done. The alterations alluded to were a re-arrangement of a portion of the plan between the Victoria Tower and the House of Lords.

"Great objections were made by some members of the Lords committee to these modifications, and many inconveniences foretold, both to her Majesty and their lordships, but I am not aware that practice has justified these predictions, or reversed the opinion of the committee of the House of Commons, which sat soon afterwards, and resolved that 'no blame was to be attached to Mr. Barry for the course he had taken, and that they had every reason to believe that all the alterations hitherto made had conduced to the convenience and general effect of the building.'

"It was at this time that many complaints began to be made in Parliament about the so-called delay in completing the building, and the anxieties consequent on the various committees and other inquiries, in addition to the unavoidable responsibilities of the architect, caused him a serious illness, and thus made a reality of that delay which, up to this time, had been imaginary, as far as he was concerned.

"Indeed, had it not been for the hearty and generous support of Lord Lincoln (now Duke of Newcastle), who was then First Commissioner of Woods, I do not think the works could have been carried to a completion by my father.

"His lordship took special pains to make himself personally acquainted with the nature and bearing of the various complaints, and having satisfied himself that they were not based on justice, threw the whole of his official weight into the scale, and gave the architect no half-hearted or stinted support in carrying out his views, until the close of his official connection with him."

All honour to the Duke for this manly, kind, and persistent support of a great man, worried almost to death; and equal shame to those who hounded on the senseless cry from which this official shield in part protected him. I need scarcely remind this assembly of the feelings with which Barry was regarded by our late esteemed president, the Earl de Grey. On the occasion of the presentation to Barry of the Queen's gold medal in these rooms, on the evening of June 3, 1850, Lord de Grey touched on the peculiar trials to which the architect of the New Palace at Westminster, as it then began to be called, had been exposed, with his usual light but most skilful hand, in the following terms:—

"* * * May you live to see the magnificent work now in your hands completed. St. Paul's was thirty-four years in its erection: you have not occupied half that time as yet, and have made a progress which, if it had depended on yourself, would have brought the Houses of Parliament nearly to completion, but the means of working have not been at your disposal. Sir Christopher Wren was entrusted with a large and striking work, destined for a single purpose. It was to be a great and glorious temple, dedicated to the worship of the Most High; but your work is to be devoted to I know not how many purposes. Sir Christopher Wren had to deal with men who knew what they wanted. Sir C. Wren, no doubt, received his instructions from men who knew the purpose to which the building was to be dedicated, and" (to a certain extent) "what was required to carry it out; but I am sorry to say that that is not always the case with respect to the buildings entrusted to you. Sir C. Wren's masters" (however tyrannical and annoying) "were few: yours are legion. I am sorry to say that august assembly which has most to do with the erection of this magnificent structure has in it a vast number of men who ask questions, make suggestions, and offer criticisms, while at the same time they do not know what is wanted, or, indeed, what they want themselves. It is not wonderful, then, that the architect should be impeded, and that fault should be found without any good or substantial ground; and yet, with all these hindrances and drawbacks, you have made a progress in the stupendous work which you have undertaken which is perfectly surprising."

Of the true nature of the labours by which alone the difficulties of his task and position could be overcome, or even coped with, Sir Charles Barry has given the simplest, the most manly, and, I verily believe, the truest possible picture, in the following words, extracted from an official letter and protest of his, which must for ever live as an indelible stigma upon those for whom the artist's noblest work was done:—"I may here add, as a ground for the increase rather than reduction of the customary remuneration in respect of public works, that, owing to the troubles, delays, and perplexities attendant upon official communications and requirements, the architect's labours and anxieties are much greater than those which he has to incur in private practice; and if this be true of public buildings of an ordinary character, it may be easily conceived that those labours and anxieties have been incomparably greater in carrying into effect such a work as the new Palace at Westminster, in which not only the Government, but committees in Parliament, and even the public, have unceasingly assumed the right of criticism and control. As one proof among many others that might be adduced of the enormous amount of labour that has already devolved upon me in conducting this national work to its present state, it will not be irrelevant to mention that no less than between 8,000 and 9,000 original drawings and models have been prepared for it, a large portion of which have emanated from my own hand, and the whole of the remainder have been made under my own immediate direction and supervision.

I consider that I am entitled to a further remuneration for special services not connected with my professional duties in respect of the works of the building. These services consist of attendances upon the Fine Arts Commission, reports, and numerous drawings prepared in compliance with the orders of that commission, frequent communications with its secretary, and the artists appointed for the decoration of the interior of the new palace; attendances upon committees of Parliament in every session from

the year 1841 to the present time, preparing data required by those committees; giving and correcting evidences, making up voluminous returns, in compliance with the orders of the House of Commons, one of which occupied myself and clerks for nearly four months; attendances to give evidence upon two Commissions of Inquiry with reference to Dr. Reid's system of warming and ventilating, preparing plans and other documents for the use of those commissioners; conferences and communications with the law officers of the Crown with reference to contracts, disputed claims, and threatened legal proceedings; numerous reports and estimates required from time to time by the Office of Woods, negotiations and arrangements consequent upon establishments of Government workshops at Thames-bank, and the superintendance of the collection of above 3,000 casts of the best specimens of Mediæval art to be found in this as well as in foreign countries for the use of the wood-carvers; preparing plans, estimates, &c. for providing accommodation for the whole of the public records of the kingdom, and other miscellaneous services."

Before such a crushing list of altogether unrequited exertions, how sadly the official sophisms of "my Lords" betray the thinness of the stately mantle through which peep out what closely resembles costive penury and meanness. Against their behaviour, and conclusions in respect to the remuneration of Sir Charles (a subject upon which I scarcely dare trust myself to speak), it must ever be a satisfaction to the members of this body to recollect that its council protested respectfully, but with firmness, and with a full appreciation of the special pleading of the representative for the time being of her Majesty's Treasury, in the following terms:—"Resolved," "that 5 per cent. upon outlay has been, and is, the only rate of charge recognized by the profession, as fairly remunerative in the average practice of architects. That it is to be deeply regretted that it should be proposed to depart from the above rate in the instance of the New Palace at Westminster; a building involving in its design and execution the exercise of the highest professional attainments. That the example which would be set by her Majesty's Government, should the course proposed be carried into execution (a legal appeal against their decision being practically impossible), is to be regarded as disastrous to the future prospects of architecture in this country, as calculated to lower the character of public monuments in England, and unworthy the Government of a great nation, whose obvious duty it is adequately to foster and protect the genius of its artists."

Under such complicated annoyances, Barry's health must inevitably have broken down altogether, if it had not been for the support, comfort, and affection he received in the bosom of his own family and the circle of his own friends. Happily for him in his domestic relations no man could be more auspiciously situated, and he has in moments of confidence expressed to me his sincere and almost solemn thankfulness for the manner in which all about him repaid the love he lavished unstintingly upon them.

In the year 1840, his eldest son Charles entered his father's office, therein to acquire that professional knowledge which such a school could so well give, and became the friend and associate of Mr. Banks, his present partner, then the chief confidential assistant of Sir Charles. Together they were actively concerned in all those varied works which for the next eight years were engrossing Sir Charles's attention, including the commencement of the New Palace at Westminster, and its prosecution, till the year 1848, in which, with the advice and sanction of Sir Charles, they entered into that professional connection founded on intimate friendship which still continues. Sir Charles's kind and valuable advice (at all times freely given to any young members of the profession) was specially afforded to Messrs. Banks and Barry, and greatly prized by them. From this time for the next two or three years the partners occasionally assisted, and at times represented Sir Charles professionally, until their own practice increased so much as to require their whole attention; and the younger son, Edward Middleton (so named after Sir Charles's old master), who had been articled by his father to Messrs. Wyatt and

Brandon, and who, on the dissolution of partnership between my brother and Mr. Brandon, about a year after Mr. Edward Barry had entered their office, served the remainder of his term with the former, had become able to assume that place of confidential assistant and representative which he held till the day of the decease of Sir Charles, who has bequeathed the drawings, papers, and books relative to the New Palace at Westminster, to the younger son, as having then for many years past been specially connected with his father in carrying out that great work.

Further of the Houses of Parliament it is scarcely necessary to speak: you know their merits: you, as architects, familiar with all that is greatest and most impressive in our art, know, as well as I know, that they will live to speak for themselves for centuries after the memory of such unmannerly detractors as Mr. Denison shall have passed away, and that as long as they endure they will tell but one tale.

No public building in Europe possesses a more ingenious and effective plan, a more perfect homogeneity of parts and style, a more graceful outline under every point of view, and greater technical excellencies and beauty. Let the most critical observer wander into every nook and corner of that enormous structure, and endeavour to detect a neglected point where the failing attention or ability of the architect have allowed a degeneration into meanness of finish, dissymmetry of axes or leading features, faulty proportion of line or detail, or anything like what is commonly called a bungle; and if he finds one it will certainly be more than I, with very close attention, have ever been able to do. Supposing, however, that he may succeed, where many others have failed, let him, full of the motes he may have found in his brother's eye, take his stand either on Waterloo or Hungerford bridge, or on the river side near Lambeth Palace, and from one of those points, on a fine afternoon, watch till the sun goes down; and if he does not lose the impression of the "motes" in the enjoyment of one of the most exquisite pictures ever architect provided to feast a painter's eye, he "hath no music in his soul."

As practical architects, we are especially bound to recognize the extraordinary technical resources called into play in the structure and fitting up of the Houses of Parliament. At Barry's call, and under the vivifying influence of his daring and intelligence, a new race of workmen seemed to spring into existence. Trained by Pugin, and led on by John Thomas, workmen grew into artists; and who shall say for how much of the admirable masonry and carving which are now so rife throughout our land we are not indebted to the judicious establishment of the school, and prototype of our present Architectural Museum, at Thames Bank, by, and under the auspices of, Sir Charles Barry? Ever appreciative of the technical skill of others, he enlisted all the energies of those manufacturers and masters who first woke up in this country to the real capabilities of industrial art. For him, Hardman, Crace, and Minton exerted all their energies; giving him at once novelty, beauty, and excellence. Products and decorations which are now common enough were, when Barry and Pugin first employed them, rarities attainable only after repeated experiments, and with extreme difficulty. Mechanical arrangements for saving labour, the capacious mind of the former at once appreciated and applied, and but for his great power in that respect, the Houses of Parliament could never have been completed, as they have approximately been, up to the present hour. It was given to him at once to know how and when to use men as tools, and tools as men—never confounding their legitimate functions, but deriving every possible aid from each and all. We cannot forget the ingenuity of all those contrivances for scaffolding and hoisting which were so ably described to us by Sir Charles's eldest son, on the 15th of June, 1857; neither can we overlook the debt we owe to one who, in all these matters, has so clearly shown us what may be done by intelligence and energy in overcoming every possible variety of mechanical and material obstruction an architect is likely to meet with in the course of the most diversified practice.

Nothing tended more to retard a general appreciation of the architectural merits of the Houses of Parliament than the necessarily slow and protracted realization of its chief vertical features and skyline. The grand horizontal continuity of the river front, admirably calculated to contrast with and enhance the aspiring loftiness of the Clock and Victoria Towers appeared comparatively unreasonable and monotonous, until those features were brought to proximate completion. But a few years will, I sincerely believe, witness an entire revulsion of feeling with respect to the popular estimation of this building; and those who will then have grown accustomed to it in its entirety, and who may have learned to apprehend the skill with which its plan has been adapted to correspond effectively with the most complicated and, apparently, antagonistic exigencies, will wonder at the growls and grumbles which have continually proceeded from those who have persisted in pronouncing sentence on their own prognostics, rather than on the real schemes and designs of their truly accomplished architect, which they would not trouble themselves to apprehend.

In addition to the works I have already alluded to, many more might be enumerated, several of which, in a less note-worthy career, would be regarded as of very great importance. Such, for instance, are the Privy Council office and Trafalgar Square alterations; the terraces and additions at Shrublands (1849-54), for Sir William Middleton, done about 1849; Gawthorpe, a Gothic mansion, in Lancashire (1850-52), for Sir Kaye Shuttleworth; Kiddington, Canford Manor, Dorsetshire (1854-5), for Sir Josiah Guest; Schools, &c., at Dowlais (1855), for the same client; additions to the residence of Sir Isaac Lyon Goldsmid in the Regent's Park; Harewood (1854-5), a large addition in a sort of Roman style to his seat near Leeds, for Lord Harewood; Duncombe Park, for Lord Faversham; a Tudor house for Mr. Currie, near Leatherhead; Ensham Hall, for Lord Macclesfied; Cobham, for Sir John Cam Hobhouse; and Kington Lacey, for Mr. Bankes. The last named an early work, the rest, with scarcely an exception, since 1840. Among his designs, either not strictly or not at all carried out, may be mentioned his projects for New Westminster Bridge, for Law Courts on the site of Lincoln's Inn Fields (made in 1838), and on a site abutting on the Strand by St. Clement's (made in 1852), for the reconstruction to a great extent of Northumberland House; of Drumlanrig Castle, for the Duke of Buccleugh; of Buchanan House, for the Duke of Montrose; and for the completion of the Horse Guards, towards the Parade.

In 1849, Barry was appointed a Royal Commissioner for the Exhibition of Industry of 1851, and as a member of the Building Committee, on which he sat with Robert Stephenson, Brunel, the Duke of Buccleugh, Lord Ellesmere, Sir William Cubitt, our President, and Professor Donaldson, he took a most active part in the early settlement of all matters relating to the building. The section of the columns, with its ingenious provisions for attachment of girders, and superposition of other columns, and the general proportions and arrangement of many of the leading parts, and the form of the transept roof, which I saw him sketch on the suggestion of Brunel, that rather than cut down or exclude the large trees, it would be better to roof them in, were all his; and but for his having been beaten on the score of time and expense on the view he took of the desirability of covering the nave, as well as the transept, with a semi-cylindrical roof, as has been done at the Sydenham Crystal Palace, he would no doubt have continued to render greater practical assistance than he did till the opening of the Exhibition.

As a Royal Commissioner he dissented from the South Kensington Museum and National Gallery schemes, and forwarded to his Royal Highness, the President, for submission to his colleagues, a comprehensive and most able scheme for an extension of the British Museum upon the site of some of the streets and squares now immediately adjoining it. In how magnificent a manner he would have dealt with the National Gallery in its present commanding position, is well though slightly shown in several of his existing sketches, which, it is to be hoped, may be published in facsimile.

Mr. Barry became Sir Charles in 1852, having been knighted on the occasion of her Majesty's making, for the first time, in February of that year, her state entrance through the lower story of the Victoria Tower, and shortly afterwards he began to gradually withdraw from active practice. In 1853 he removed to Clapham. Among his last and finest designs were the series for great additions and alterations to Clumber, for the Duke of Newcastle in 1857; plans and sketches for the construction of a building for the Royal Academy of Arts on the site of Burlington House; drawings for the Halifax Town Hall; and that design, or rather collection of designs, for the improvement of the western portion of London, which he contributed as a sort of rider to the designs of his son Edward for the Government Offices. This last I venture to consider one of the most important designs he ever made. I look upon it as a legacy to his country of almost corresponding grandeur of treatment with that bequeathed to us by Sir Christopher Wren, and prepared after the Fire of London. Could but the scheme conceived by the architect who has shown us in the towers of Westminster and in the general composition of the Houses of Parliament what he could supply materially for the embellishment of the metropolis be realised, there can be no doubt that London would be the most beautiful and majestic looking city the world has ever seen.

In conversations I have at different times had on the subject of architecture with Sir Charles, he has always insisted on the indispensability, of symmetrical arrangement, of sustained tranquillity of effect obtained through the reduplication of similar parts, of study and refinement in detail, and especially of care in the grouping of masses and the treatment of the sky line in connection with landscape effects. It was his general practice, he has told me, to get out his roof plan as one of the earliest drawings in working out any design. The architects for whose works he generally professed the greatest respect were San Michele, Michelangelo, Vignola, Peruzzi, Soufflot, Perrault, Vanvitelli, Gibbs, Chambers, Jones, and Wren. For the latter two his admiration was unbounded, and it was one of the latest acts in his life to give what assistance he could to the embellishment of Sir Christopher's great masterpiece.

In the summer of 1858, at the suggestion of Mr. Cockerell, Sir Charles Barry was invited to become a member of the Committee for Administering the St. Paul's Cathedral Fund, raised for the purpose of assisting the Dean and Chapter in providing—firstly, for the special evening services, and afterwards for the decoration of the cathedral. He entered heartily into the proceedings of this committee, and scarcely missed a single meeting. The surveyor to the fabric is anxious to bear witness with gratitude both to the value of his councils and the uniform kindness of his manner.

As it was sometimes necessary in the alterations that have been decided on, and already partially carried out, to take steps regarding which there could be no positive indications of Sir Christopher's mind (although, fortunately, in the main, there are such indications), it was of the greatest value to have an adviser who was so capable of deciding what Sir Christopher Wren would have been likely to have done under the new circumstances, and one who was independent of a superstitious veneration for the original arrangements when their change became desirable in consequence of the alteration of other parts. One of the last letters written by Sir Charles Barry was on the subject of the works in the Cathedral to the Dean of St. Paul's, by whom his premature loss is deeply regretted, as it is by all others connected with the cathedral or the committee.

On all possible occasions Sir Charles Barry urged the necessity for a system of more complete and profound architectural study than has yet been organized amongst us. Quietly, though I have reason to know most strenuously, his views on this head were pressed upon the attention of his colleagues in the Royal Academy, and it was his earnest desire that the professorship of that body should be elevated into real practical efficiency.

In the formation of the Architectural Publication Society, Barry gave valuable and willing aid, but from compliance with the request of the committee for assistance towards the illustrations, he always excused himself on the ground that his sketches were too slight to be placed before the public. When, however, the article "Baalbec," compiled for the "Dictionary of Architecture," issued by that society, was submitted to him, he acceded most readily to the wishes of the committee, and prepared the description (afterwards printed) of the ruins at that place, from his own memoranda and sketches. This assistance was the more remarkable and gratifying, as it is probable that, with the exception of a short but often referred to contribution to Gwilt's edition, in 1825, of Sir William Chambers's Treatise on Architecture, this account is the only literary production from his pen; in fact, he had quite sufficient employment for it in the many and able reports and descriptions he was daily called upon to make. His interest in the Architectural Publication Society he kept up to the last, having replied within a month before his decease to an inquiry made by the secretary as to the peculiarity of sound in a certain room in one of the buildings erected from his designs. It is also reported that he was engaged upon an account of the Architecture of the Holy Land for the same work, at the date of his untimely demise.

In his comparative leisure and retirement from active life at Clapham, his friends earnestly hoped that Sir Charles would find opportunities of regaining that strength and health which had been seriously impaired by a life of such intense and incessant exertion and anxiety. Their wishes, which seemed to be rapidly in process of realisation, it has pleased God to suddenly and awfully frustrate: how, after the exquisitely simple narrative given you a few evenings ago by Professor Donaldson, it is unnecessary for me now to detail. It may suffice to record with thankfulness, that dreadfully unexpected as was the summons, it fell upon a Christian man, who had long looked upon death as a Christian man should, and whose piety was not less unobtrusive and genuine than were his faith, hope, and charity.

I might of course have urged many other points upon your attention in respect to the powers of Sir Charles Barry, as testified in each of the various works to which allusion has been made; but there are limits both to my powers and to your patience. The curtness of the few remarks with which this memoir, in spite of its length, obviously too much abridged by stress of time, must necessarily be terminated, will be of little consequence, as no doubt many an abler pen than mine will be enlisted in drawing the most profitable instruction from so great an example, not only of what is excellent in art, but of what is most admirable in private life. Let us hope that whenever that extended memoir which may, I believe, be looked for from the great and united talents of his sons Alfred, Edward, and perhaps Charles, shall appear, it will prove to supply all lacunæ existing at the date of its publication, and that it will illustrate, copiously, both by pencil and pen, the life—artistic, personal, and historical—of Sir Charles Barry. It is satisfactory to think that he has not passed away without leaving materials for the picture of him, which should obviously be placed in the National Portrait Gallery, or for the statue which should find its appropriate niche in one of the halls of the New Palace at Westminster. His portrait, by Harland, has been engraved; that by Hayter, is in the possession of the family; one by Pickersgill exists. His bust has been modelled by Behnes; and last, not least, an excellent daguerreotype of him, still in good condition, was taken by Claudet for his son Charles, immediately previous to his visit to Italy in 1847; and another, not less satisfactory, was executed of him by Kilburn, in the present year. An engraving from this last may, I hope, accompany any extended memoir or biography.

I know not how any moral that the ablest rhetorician in the world could draw from Sir Charles Barry's professional career could be made to speak more strongly, or to admonish us more stringently, than the facts of his life, and the monuments he has left behind him, do for us unerringly, if we will but open our hearts to apprehend and study them aright. His incessant labours, first to learn and then to practise, again to learn and again to practise, and again, and again, and again to learn and practise, so

long as his physical energies could support the activity of his intellect, should convey to us all a lesson of profound humility, and a stimulus to exertion of the most active kind.

If he, with all his natural genius and aptitude for art, could achieve success, in the measure in which he did achieve it, only by never ending, ever re-beginning toil and study, how can we emulate, even an approximation to his excellence in our art, without an exercise of both, increased in the ratio of the disparity between our own natural powers and his? His life is only another practical illustration of that which the lives of all the greatest artists who have ever lived—of Titian, of Michelangelo, of Raffaelle, of Leonardo da Vinci, of Albert Durer—already bear witness to—that study and practice must in art ever go on hand in hand. Study without practice will but make the pedant; practice without study can but multiply busy worthlessness. He who would ever be in our art what Sir Charles Barry was must don the same armour, and fight for every step in the upward struggle, with the same weapons, and with equal courage and pertinacity.

I assure you, gentlemen, that in the preparation of the few particulars I have brought before your notice this evening, I have used every possible exertion to gather together the fullest and most correct information that time would allow me to seek or authenticate. I am now forced to break off somewhat suddenly, because I have been unable to complete my story as I could have wished. I have, therefore, to throw myself on your indulgence. I will now only add a few words, which I should have incorporated in my paper at greater length if time had permitted. The points which I think young students would do well to note and take most to heart from the splendid career of Sir Charles Barry are, firstly, that however great their ability might be, and in whatever auspicious circumstances for the acquirement of a knowledge of their profession they may be placed, they never can hope to acquire anything approximating the celebrity he attained unless they adopt the same means by which he rose—a union of study with unstinting and untiring industry; and secondly, that graphic power must be acquired in early youth to be made serviceable in manhood. We have seen how Sir Charles Barry exercised not only industry but learning, as long as head and heart had power to work. Up to a very short time before his death his mind was actively engaged in architectural composition, and I have seen studies of remarkable beauty made by him very recently,—the sketches for the works at Clumber I may particularly note. The masterly style in which the lines of the plan were arranged, and the way in which he saw intuitively the effect of particular vistas, and combinations of form in perspective, were most remarkable; and in looking at those drawings any one might readily imagine them to be the works of Vanvitelli, Palladio, Quarenghi, or any of the greatest masters of picturesque effect who have lived in former times. After the exquisite way,—exquisite from its simplicity,—in which Professor Donaldson related to you, on the occasion of your last meeting in this room, the circumstances of Sir Charles Barry's death, I feel that I need not dwell upon them. It only remains for us now to unite, to-morrow, in paying the last tribute of respect to his memory, by reverently following his remains to their final resting-place on earth; and in doing so it may be our consolation to remember, in the words of the magnificent anthem which pealed last over the grave of Robert Stephenson, and may very probably be re-echoed over that of our departed friend, "that his body is buried in peace, but his name liveth for evermore." After a pause, Mr. Wyatt added,—I may possibly be in possession of some facts and dates which I have not given in my paper, and if so, I shall be happy to afford the members any further information in my power.

Mr. A. J. B. Beresford-Hope, Hon. Fellow, hoped the meeting would allow him to express that feeling which must have arisen in the hearts, if not to the lips of all present; and to propose a vote of thanks to Mr. Digby Wyatt, to whom they all owed such a debt of gratitude for the labour of love which he had performed, with so much good taste, ability, and feeling, and at the same time with a

playful fancy, which had been subordinated in the best taste to the solemn occasion which had called them together. The majority of those present knew Sir Charles Barry personally, more or less; and those who only knew him by his works would equally appreciate the brilliant sketch which Mr. Wyatt had given them,—a sketch which he trusted might not appear to the public only as it had been written, because he saw in it the foundation of an enlarged and illustrated memoir, in which form it ought to appear;—an illustrated memoir of one whose memory should not go down to posterity only on a collection of inferences from his works, but whose works themselves ought to be collected and illustrated for the guidance of students in future ages. In the present day, when the battle of styles was waging so extensively and warmly;—none of them ought to shirk the fact that this battle was now being fought,—some of them were Goths, and some of them were Greeks;—in the present day, and with this battle waging, such a dispensation of Providence as had called them together must awaken all present to the vanity of many of such questions of taste, and must assure them that their differences on questions of cornice or steep roof should be overpowered and overwhelmed, when in solemn silence they should gather round the bier of a great and good man, whose name was the property of his country. He felt that on the morrow, when they should meet in Westminster Abbey, there would not be any feeling with respect to differences of taste, nor would any shadow of question as to style, whether Greek or Gothic, cross their minds when they assembled to render honour where honour was due. With those feelings, which they must all participate in, they could not but express their gratitude to Mr. Wyatt for his eloquent tribute to the memory of Sir Charles Barry, and he therefore begged leave to move the thanks of the meeting to him for that admirable paper.

The PRESIDENT said that, without awaiting a seconder for the motion, which he was sure was seconded by every one present, he might observe that no one who (like himself and other gentlemen present) had traced the life and watched the course of the late Sir Charles Barry could help admiring the accuracy of detail with which Mr. Wyatt had traced the late distinguished architect's biography. In little more than a week from Sir Charles Barry's death it had been sketched and most accurately laid down. Mr. Wyatt's paper must always form the foundation and back bone of any biography, such as they must all desire. Mr. Wyatt, having restricted himself to his "Architectural Career," had not been able to enlarge upon the affectionate personal and moral qualities which so remarkably characterized the late Sir C. Barry He might advert especially to the well-known integrity of their late friend in the conduct of so many and such extensive works, and his kindness and consideration for everybody about him. The suavity of his disposition rendered all who ought to obey his authority well content to do so. These varied and admirable qualities every one present must appreciate and most earnestly admire, and desire to see more fully recorded by Mr. Wyatt when he had the leisure to do so. He was sure they would now all unite in voting their cordial thanks to him for his eloquent and agreeable (though brief) memoir of Sir C. Barry.

Mr. GREEN, Associate, begged to call the attention of the meeting to the fact that a Life of Sir Charles Barry would be immediately prepared by his sons, the Rev. Alfred Barry, of Leeds, and Mr. Edward Barry, with the assistance of Mr. Wolfe;—than whom few gentlemen were better qualified to execute the task. Mr. Wolfe, especially, from his early and intimate association with Sir Charles, would be able to supply many interesting particulars yet unknown to the profession.

Mr. TALBOT BURY, Fellow, referred to the allusion made by Mr. Wyatt to the connection between the late Sir C. Barry and Mr. A. W. Pugin. His own connection with Pugin was so close and intimate that he might almost say he knew all his thoughts. The connexion which had existed between Barry and Pugin was of a far more intimate nature than most persons were aware of. Their first professional

intercourse was in King Edward's School, at Birmingham, in the details of which Pugin had to assist. They then worked together while Pugin was residing at Salisbury, and this led on to the Houses of Parliament. As Mr. Wyatt had stated, Barry's first design was not Gothic at all, but from the arrangements that were made he had to change his design altogether; and it was arranged that Pugin, who was then engaged in assisting a firm who practised north of the Tweed, should come up to assist him, and they worked together from six in the morning till ten at night. Pugin acknowledged that his ideas of the plan were completely crushed, and in every way inferior to Barry's, which was perfection. Every suggestion afterwards made by Barry for alterations in the original design was declared by Pugin to be an improvement. Praise like this was extraordinary, and it was to the honour of both that neither sought to deprive the other of his share of credit for the work done. Pugin always recognized his own position as a workman, and that the whole design, the *tout ensemble*, was due to Barry only. At the funeral of Pugin only four mourners attended,—Sir C. Barry, himself, and two others *not* members of the family, and none could be a more sincere mourner for him than Barry. He felt that he had lost a friend, and for the time his great mind was prostrated, and put on all the humility of suffering. The same feeling would pervade their minds to morrow, and they would show for Barry the same sorrow and the same feeling which he had displayed for his poor friend Pugin.

Mr. M. Digby Wyatt, in calling the attention of the meeting to the series of designs which had been made by Sir Charles for the block plan in the new Government offices competition, and which, though they were exhibited in Westminster Hall, might have escaped the particular attention of some present, owing to their being surrounded by numbers of more pretentious drawings, expressed his conviction that these should be cared for and preserved, and that in time to come they would be regarded with the same feeling as that with which the present age looked upon the plan of Sir Christopher Wren for the rebuilding of the city. He hoped to see them published in facsimile.

Mr. Edwin Nash, Fellow, said that the new wing of St. Thomas's Hospital should be omitted from the list of Barry's works. The wing was designed by Messrs. Samuel Robinson and James Field as part of a general plan for rebuilding the hospital. To the former gentleman, an aged practitioner, he (Mr. Nash) was at the time an articled clerk, and not only made the working drawings for the first wing, but superintended their carrying out. The second wing was executed solely by Mr. Field, and with the exception of the latter gentleman, and Mr. Currey, the present surveyor to the hospital, he believed he was the only person competent to give correct information on the subject.

Mr. Edwin Hall, Visitor, observed that there was an impression on the part of the family of Sir C. Barry that he had been in some way or other connected with the works at St. Thomas's Hospital.

Mr. Morris, Associate, said that he had been engaged with Mr. Railton in the preparation of the design for the Houses of Parliament, which, together with that of Sir C. Barry, had obtained a premium; and it was his own feeling, and that of Mr. Railton, notwithstanding their partiality for their own design, that they had been fairly beaten. One striking feature in Barry's design was its oneness,—its singleness and simplicity of design. It was a single building; whilst many of the other designs presented a great series of separate buildings, resembling a town more than anything else.

Mr. G. G. Scott, Fellow, said that he felt most strongly on the subject, but under the influences of the present time he was incompetent to give due expression to his feelings. He could only say that he most cordially concurred in all that had been said in admiration of the late Sir C. Barry.

The President put the vote of thanks, which was carried unanimously.

Mr. M. Digby Wyatt in acknowledging the vote of thanks, said, permit me to observe that I think it will be perfectly clear that my paper was commenced with considerable care; I sincerely wished

to have been able to have followed it out with equal detail, but I found this morning that it would require much more than a day's work of the most intense kind to do so, and that although I could not possibly get through it, I determined to do all that I could do: but it was not in my power to avoid all but breaking down at the end.

The PRESIDENT and Mr. T. L. DONALDSON both protested against the conclusion that Mr. Wyatt had broken down. He had merely fallen short from want of time. The facts he had brought forward were of the highest and deepest interest, and it was most desirable that he should have an opportunity of concluding his most valuable memoir.

Mr. WYATT promised to make some additions to the latter part of his paper, which as read was in a somewhat less complete state than that in which it now appears, and the meeting then adjourned.

ON THE ORIGIN AND DEVELOPMENT OF THE USE OF CRYPTS IN CHRISTIAN CHURCHES FROM THE EARLIEST PERIODS.

By Arthur Ashpitel, Fellow. Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 4th, 1860.

There are few objects, the works of man's hand, that affect the mind with more solemnity than the crypt of a cathedral. The massive character of the edifice, which not only carries its own "arched and ponderous roof," but also the more imposing and heaven-aspiring building above it; the sepulchral aspect of the vaults; the dim, broken light, struggling faintly from aisle to aisle, which scarcely is sufficient to guide the gazer's feet; the enduring solitude; the silence, broken perhaps at intervals only by the distant roll of the diapason of the organ, descending from above through the massive masonry,—all tend to affect the mind with the deepest solemnity: and yet it is curious that less perhaps has been written as to these extraordinary fabrics than any parts of our noble ecclesiastical edifices. They seem to have been passed over as certain substructures necessary to carry the building above, which, being there, were used for the purposes of sepulchral rites, or of sepulture itself, but of whose origin and history little or nothing can be related.

It is my purpose to endeavour to give some slight sketch of the origin of these structures, and the progress made in their size and importance for many generations, till from some unknown cause they almost suddenly ceased to be erected as parts of Christian churches.

The construction of subterranean chambers of all kinds was probably suggested by the existence and use of natural caves.[1] The desire to enlarge these for purposes of dwelling, concealment, or stowing away articles of value, naturally would lead to the formation of rock-cut caverns by excavation. It appears also from Scripture that such caves were early used as places of sepulture. Thus we all remember in the Book of Genesis[2] that Abraham purchased the Cave of Machpelah from Ebron the Hittite for 400 shekels of silver, that he might there inter the body of his wife Sarah.

The earliest subterranean excavations are probably the catacombs of the Egyptians, which are described by most authors, but particularly by Pococke. He gives accounts of some to the south of the Pyramids of Saccara, others near Alexandria, and particularly some, of extensive dimensions, near the old canal of Canopus. These last consist of large galleries running out of each other at right angles, in the walls of which are a number of excavations ranged side by side, more resembling the boxes in which we keep our papers, and which we familiarly call pigeon-holes, than anything else. He has shown them in ranges; each opening large enough to hold a mummy placed endways, each range containing eight openings, side by side, and three in height. Whether these suggested the catacombs of Rome and of Sicily it is but of little use to enquire, as the subject more immediately before us is the crypt itself.

The word, as we all know, is derived from the Greek κρυπτω, I hide, or conceal. But it seems curious that the word κρυπτη, as applied to any similar construction, is of rare, if not of solitary

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[1] For accounts of early dwellers in caves, or Troglodytæ, see Herodotus, "Melpomene," 183; Strabo, the early part of the 17th Book; Diodorus iii, 14; their annotators, and many other incidental notices in classic antiquity. In Scripture History, caves seem to have been rather places of refuge than ordinary dwellings: Gen. xix. 30; Joshua x. 16; 1 Sam. xiii. 6; 1 Kings, xviii. 4, &c. &c.

[2] Genesis xxiii. 15, &c.

Fig 1

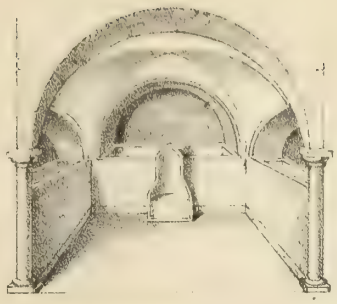
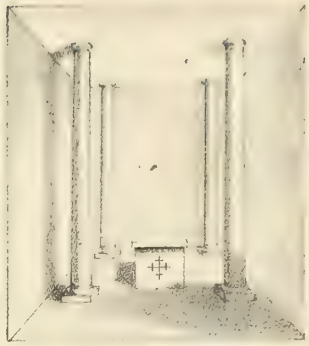


Fig 5



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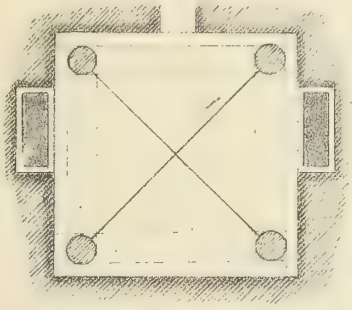


Fig 4

Fig 12

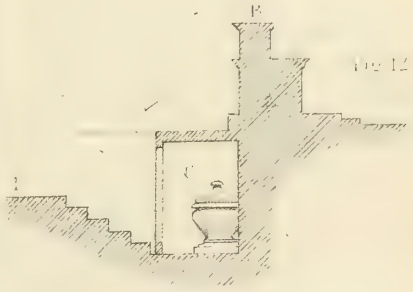


Fig 2

Fig 3

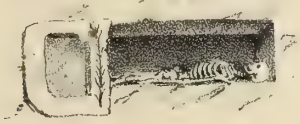


Fig 10

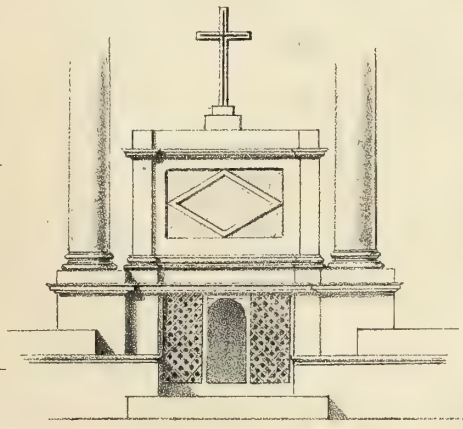


Fig 8

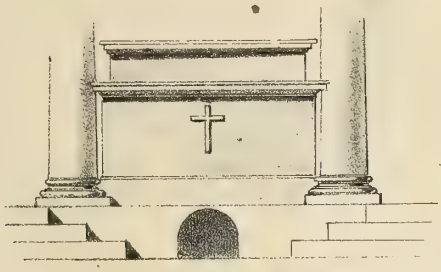
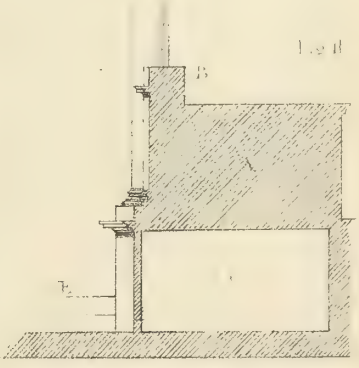


Fig 11



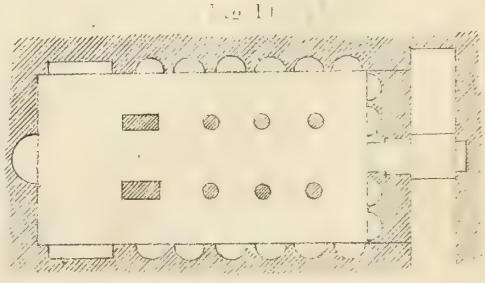


Fig 9

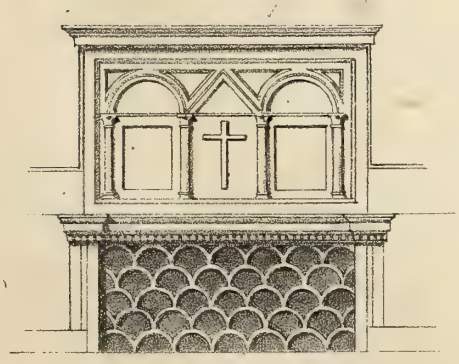
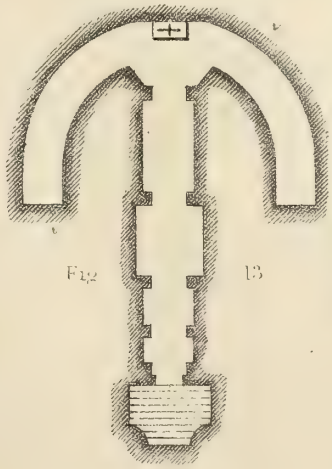


Fig 13



occurrence among the Greek writers. It is used by Athenæus[1] in describing some of the works of Ptolemy Philopator. In this passage the word κρυπτη seems to mean a vaulted roof, and cannot be said to apply to a *subterraneous* building, as the chamber it covers is expressly called υπερωον, or an "upper chamber." The Latin word "crypta" (no doubt derived from the same root) is also of rare occurrence. We find it in Juvenal,[2] and there evidently it means part of the great sewer, or "cloaca maxima." It is used also by Petronius (p. 47, Amst. 1669) in a passage which, according to Burman, means the same thing; but Erhard, on the authority of an old glossary, considers it to be a subterranean chapel dedicated to the god Priapus.[3] In Seneca (ep. 57), and in a passage in Suetonius (Caligula, 58), the word "crypta"[4] clearly means a subterraneous tunnel or passage. Vitruvius uses the word but once (lib. vi. 8), and that in the list of offices necessary to a country house, viz.:— "Stables and sheds in the vestibules (or outer courts), and crypts, (cryptæ), granaries (horrea), and apothecæ (stowage places, particularly for wines), see Julius Pollux, vi. 11, and other places for preserving fruit, which should be in the houses."

An attempt has been made to show, as Varro de R. R. (lib. i.) tells us the corn was often kept in pits under ground, that the "cryptæ" must necessarily be subterraneous; but, as "horrea" clearly are the granaries, the proof is defective. In fact, all we can gather from the passage in Vitruvius is that "cryptæ" were used, among other places, "ad fructus servandos."

It is therefore doubtful whether the word in classic times ever had the signification which we now give to it; still less should we confuse it with the word "crypto-porticus," a construction which resembled rather the walks of one of our cloisters than what we call a crypt: although we gather from the description of Pliny (ep. ii. 17),[5] and from Sidonius Apollinaris (ii. 2), that these walks were sometimes partly sunk in the ground to keep them cool. The best example extant is perhaps that round the garden in the villa of Diomedes, at Pompeii.[6]

But before going directly into the history of the crypts in Christian churches, it will be well to advert to some of the Etruscan sepulchral chambers, which resemble very closely the early crypts, and by which they probably may have been suggested. Like the tombs of the Greeks, they were always below ground; in fact, where this was difficult to accomplish, from the flatness of the country, a circular apartment was built, and the earth piled over it so as to completely cover it. The Greek tomb was generally a sort of chamber to enclose the body; sometimes a mere stone coffin; sometimes very much like our own family vaults, but without the arch. The Etruscan tomb, on the contrary, was the banqueting-hall of the departed spirits.[7] Hewn out of the solid rock, the ceiling was, nevertheless, carved to resemble the timber rafters of a chamber, the walls panelled like wainscot,—benches,

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[1] Deipnosoph. v. cap. 8.

[2] Juvenal, Sat. v. line 104,—

"..... et ipse
Vernula riparum pinguis torrento cloaca
Et solitus mediæ cryptam penetrare Suburræ."

[3] Some have supposed the crypt alluded to was the famous one at Naples, in which was a chapel to this god. The whole passage is very obscure, especially as the text is imperfect, and what took place was "ante cryptam."

[4] "Cum in crypta per quam transeundum erat, pueri nobiles ex Asia .... ut eos inspiceret hortareturque restitit." Caligula had risen and was going out when he was killed in this crypt.

[5] See also Lib. v. Ep. 6. "Subest cryptoporticus *subterraneæ similis:* æstate incluso frigore riget, contenta que aëre suo nec desiderat auras nec admittit."

[6] The *villa suburbana* of Gell: Pomp. vol. 3. There was a terrace above the cryptoporticus, in which were a large number of empty amphoræ stuck upright in dry sand. A conjecture was ventured that these were put out to be washed out preparatory to the vintage. The destruction of Pompeii took place at the end of August.

[7] See also Dennis, "Cities and Cemeteries of Etruria," i. 262; also, *ib.* i. lxvi. p. 59, 157, &c. &c.

arm-chairs, footstools, tables, all hewn from the solid rock, fill the chambers; while the walls are hung with weapons and tripods; lamps and other utensils lie about; and the panels are filled with pictorial representations and stucco figures. There is, in fact, little doubt that the Etruscan subterranean chamber was a complete copy, in design, decoration, and arrangement, of an Etruscan dwelling-house. A plan and interior view of the famous tomb at Tarquinii, commonly called that of the Cardinal, is given by Canina ("Etruria Mar.," pl. 84). The plan is that of a square chamber cut out of the solid rock, the ceiling or roof of which is supported by four solid piers, strongly resembling that of some of the early Mediæval crypts.

It would now be a very curious and interesting inquiry as to the customs of sepulture among the ancients by burning or by burial; but it would, though bearing directly on the subject, be too wide and extensive a research for the present occasion. Suffice it to say, that the customs of sometimes burning, and sometimes burying the dead, were practised by all the three nations—the Greeks, Romans, and Etruscans. A very high authority, the Canon di Iorio, who had excavated as largely as any one, says ("Sepul.," p. 28) that, among the Greeks, not more than one body out of ten was burned; while, among the Romans, not more than one out of ten was buried. In fact, it appears from a passage in Homer ("Iliad," vii. 334), that burning was practised among the Greeks as a matter of convenience, for Nestor recommends that the bodies which had fallen in battle should be sought out and burned,[1] that the remains might be more easily carried to their children when the heroes returned to Greece. Among the Romans we have the direct testimony of Pliny ("Hist. Nat.," vii. 55) that in ancient times their practice was to bury the dead; and this prevailed among the old families even till a late period; Sylla being, as he informs us, the first of the Gens Cornelia whose body was burned.[2]

At the time of the Christian era, as we shall see, the practice became almost universal; but, as Christianity became more diffused, it gradually fell into disuse, till Macrobius ("Saturn." vii. cap. 7), who is supposed to have written his work about A.D. 420, tells us, in his days the practice of cremation was quite left off, and it was known to him only from reading.[3]

But whether the one or the other of the modes were preferred by the Romans, one rule was strictly observed. It was a law of the Twelve Tables neither to burn nor bury a dead body within the city walls, a space which of course included also the "Pomœrium." The words are given by Cicero in his treatise ("De Legibus," l. 2) thus, "Hominem mortuum in urbe ne sepelito neve urito;" and this law prevailed for many centuries after the Christian era.

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[1] The passage is nearly literally as follows:—

"Atreides, and ye heroes of the fight!
Many of the fair-haired Greeks to-day have fallen,
Whose blood now darkens swift Scamander's wave.
Struck by fierce Mars their souls have passed to Hades.
Ye still must guide the battle; but, when dawn
Shall stay your hands, a circuit round the field
With oxen and with mules, 'tis ours to make,
And sadly bring the dead together here,
And burn them near the ships, that ye may bear
Home to their children the paternal ashes,
When we again shall seek our Father Land."

[2] And this, Pliny tells us, arose from a fear that the followers of Caius Marius might at one time tear his body from the grave as he had done by that of their leader. "Idque eum voluisse veritum talionem, eruto C. Marii cadavere."

[3] "Deinde licet urendi corpora defunctorum usus *nostro sæculo nullus sit, lectio* tamen docet eo tempore quo igni dari honor mortuis habebatur," &c. &c. The passage following is strangely curious:—Macrobius says, when many bodies were burned together, the attendants on the pyre always put the body of one woman to those of every ten men that the whole might be quickly burnt off. He adds gravely,—"Ita nec veteribus calor mulierum habebatur incognitus."

One great barrier which the early Christians invariably opposed to the persecutions of their heathen rulers was this,—that they scrupulously obeyed the laws of the country wherein they may have sojourned, or of the superior who governed; provided that these laws did not positively command them to do anything absolutely contrary to their faith,—the most prominent of which was the sacrificing to idols. In other respects they declared themselves the most faithful of citizens. Accordingly, we find there were no burials within the bounds of any cities, either Christian or Pagan, for several centuries after the Christian era.

The Roman antiquary will remember how he must have been struck to see the huge vestiges of tombs and monuments stretching away across the Campagna down the Flaminian, Salarian, Prænestine, and above all, the Latin and Appian Ways. For miles the memorials extend along both sides of the road leading to the city; for miles, tombs—some of gigantic, some of moderate, and some of very small proportions—line the roads leading to the refined city that once governed the whole world, and must have given a strangely impressive effect to its entrance,—that the introduction to the presence of the greatest among the living should have been through the silent ranks of the remains of the dead.

But the Christian feeling revolted from the practice of burning the dead; and this variation from the conventionalities of society (as it is the fashion to express ourselves in this day) gave rise to great prejudice on the part of the Pagans against the Christians at that time. Many of my hearers must have read the delightful apology of Minucius Felix, for the Christian religion. This beautiful little treatise, in manner, language, and elegance, worthy to be compared to some of the best philosophical essays of Cicero, introduces the Christian Octavius, walking with his heathen friend, Cæcilius, at Ostia. The mighty ocean, the everlasting hills are before them, exhibiting the unlimited power of the Deity; while the occupation of a few boys, who are amusing themselves with pitching smooth pebbles into the sea, and watching them spring from wave to wave, is a fine illustration of the vanity, the nothingness of human pursuits. The friends begin to moralize, and the Pagan remonstrates with his Christian companion as to some gross charges brought against them—such as worshipping an ass's head,—an accusation, by the way, which it appears from some coins may not have been unfounded as against that strange sect the Gnostics, who represented their deity, Abraxas, with such a head. After this had been refuted, Cæcilius begins to blame the Christians for some peculiarities he deems absurd. He objects that they are not content, like other people, that their dead bodies should be burnt; because they fancy, if they should be deposited in the earth instead, they are to arise again to the skies at some future time. But the Christian apologist answers him,[1] "What care we if our bodies are dried up in the sands, or perish in the waters, or are consumed into cinders, or are dissolved into vapour—the Almighty receives the elements. Nor do we, as you believe, fear any damage to the soul from any manner of sepulture, but we follow that which we consider the older and better method, of burial in the earth." I will not pursue the eloquent and touching explanation of the Christian; it is too long for our purpose. I only quote a short part, to show how the customs of the heathens and Christians differed at that time, and how the latter adhered to the practice of inhumation.

But this was written scarcely a century after the apostolical period, and before the more organized persecutions which followed; the history of which, though deformed by ridiculous legends and exaggerations, is still a very great and affecting part of the annals of our religion.

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[1] De Idol. Vanitat. p. 101, Oxon, 1678. "Corpus omne, sive arescit in pulverem, sive in humorem solvitur, vel in cinerem comprimitur, vel in nidorem tenuatur, subducitur nobis; sed Deo elementorum custodi* reservatur. Nec ut creditis ullum damnum sepultura timemus sed *veterem* et *meliorem consuetudinem* humandi frequentamus."

* Some editions read "custodia."

To go into this history would be not only beside the purpose, but far too extended an inquiry for the space we have. Suffice it to say, from the exigences of the persecution of the Christians arose two most important circumstances—the use of the basilica as a place of worship, which afterwards became the settled form of the Christian church; and the use of the catacombs, the "cubicula" or crypts, in which were the principal cause of the use of crypts in churches. It appears that at first the Christians interred the dead in open fields, which were called "areæ," and we have the testimony of Tertullian ("ad Scapulam," 3) that when Hilarion was prefect, the use of these "areæ sepulturarum" was denied to the Christians. "Let there be no areæ," was the decree. A similar expression is found in the Acts of St. Cyprian. Eusebius (vii. 11–12) tells us, too, that their cemeteries were taken away from the early Christians, and not restored to them till the time of Gallienus, A.D. 262.[1]

In fact, one part of the policy of the persecutor was to deny the rites of sepulture to his victims. According to Prudentius, the body of Hippolytus was cut into little pieces and scattered abroad. Many bodies were burnt, and the ashes given to the winds; many thrown into wells, and others into the sea. One of the most curious instances is cited by Baronius, in the Acts of the Martyr Tharacus, or Taracus.[2] The Præses Maximus, who seems to have resembled Judge Jeffereys in his violence of temper and language, burst out at the martyr—"Won't I destroy you? Yes! and, as I said before, even your remains. The little women shall not roll up *your* carcase in fine linen, and cover it with ointments and odours. No! I'll command you to be burnt, you scoundrel, and your ashes to be scattered to the winds."

Under these trying circumstances, one tradition tells us the Christians were compelled to flee to the crypts, or catacombs, both for the exercise of their worship and for the burial of the dead.

Another tradition, recorded by Baronius, states that the Christians, being condemned by their persecutors to labour in the mines like slaves, some of them were sent to these sand excavations, and took the opportunity to use them for the purposes before named.

Through the greater part of Italy, particularly round Rome and Naples, as most of us are aware, there are vast beds of an arenaceous substance called pozzolano. It is a very close and compact body of sand, mixed with a sort of burnt argillaceous matter in granules, very much resembling pounded brick, and is evidently of volcanic origin. Being the best possible material for making hydraulic mortar, it has been dug out in a countless number of excavations for ages; in fact, the excavations are going on now.

The material is very easily moved, and yet stands with extraordinary firmness; in truth, unless water has got amongst it, there is scarcely an instance of the roof or walls (so to speak) of an excavation falling in. It, however, varies much in hardness and quality, which probably accounts for the irregularity of the passages; the workman turning to the right or left, or ascending or descending, as the material was more or less easily worked, or more or less valuable. It also contains frequent masses of tufo, in which the "cubicula," or crypts proper, are generally excavated.

The Romans called the pozzolano "arena," or sand, and the excavations "arenariæ," or sand-holes. Many of the Roman burial-places, for depositing the "ollæ," or urns, which contain the ashes

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[1] The whole of this Epistle of Dionysius of Alexandria to Hermamnon is curious. The prefect Æmilian refuses to let the Christians make conventicula (*συνοδους ποιεισθαι*) or to "go (as they call them) to cemeteries" (*ἠ ἐις τα καλουμενα κοιμητηρια εισιεναι*). It is cited at length, Euseb. Hist. Eccl. vii. 11. The same author (ix. 2) tells us Maximin refused to allow the Christians to meet in churchyards.

[2] Acta Tharaci, apud Baron, A.D. 290. "Præses dixit, 'Nonne sic te perdam, et sicut antea prædixi, et reliquias tuas? Ne *mulierculæ* in linteamine corpus tuum involvant, et unguentis, et odoribus adornent. Sed, *sceleste!* jubebo te comburi, et cineres tuos in ventum dispergam.'"

of the dead, are excavated in this soil. But the most remarkable of all are these celebrated "crypts" in the Catacombs near Rome.

What are commonly called catacombs[1] are innumerable narrow passages tunnelled out in the solid earth, not more than 4 or 5 feet in width, and about 7 to 10 feet in height. Having been excavated without plan or settled purpose, they run in every conceivable direction—some side by side, some over each other, forming a most inextricable labyrinth—and that of such dimensions as to astound and bewilder the visitor. Aringhi has given several plans of parts of these; it will be seen, on reference to his work, they form mazes of passages, like the adits in a mine. The principal plans given by this writer are those called the Catacombs of St. Callistus, St. Agnes, and St. Marcellinus. In one plan, that of a small part of the former, it has been estimated there are full five miles in length of these adits. In the time of Baronius, forty-three of these cemeteries were known: at present it is probable twice the number have been found. Taken together, it is estimated that there is a sort of net-work of these passages under Rome, which must measure at least 100 miles.

In the sides or walls of these are a countless multitude of excavations, mostly about half a yard deep and about 6 feet in length; in fact, square horizontal niches, to hold the body—not of the pigeon-hole fashion of the Egyptians, but like bodies, laid lengthwise, on a sort of shelves.

Sometimes there is but one body in the height; sometimes two, three, and four, and in the catacomb of S. Saturninus are many places where no less than five bodies are deposited, one above the other, in the height of the passage.

The front is covered by a slab of stone, or very commonly of marble, and sometimes of terra-cotta, on which is usually carved the name and age, and any other particulars of the deceased, and generally some Christian emblems.[2]

Some, however, are constructed by cutting a semi-circular arch into the natural wall, and then sinking beneath it an excavation to receive the body, which is afterwards covered with a stone slab, and forms a tomb much like the monuments recessed into the walls of our cathedrals.[3] These tomb tops have been used as altars.

To give some idea of the vast numbers deposited in this city of the dead, it has been reckoned that there are upwards of 170,000 bodies in the crypts of St. Sebastian only.

I know nothing more extraordinary than visiting these solemn places, which, on the first occasion, I did alone. It was at St. Sebastian. I had seen the noble church, and was then directed to a small door which opened, and there was a descent to the catacombs,—a narrow passage scarcely higher than one's head. At the entrance I was met by a single bare-footed monk, in the coarse brown robe of his order, the cowl of which he drew over his brow, to ward off the cold; it was winter, and the air was chilly to him, for below, in the excavations, it is warm and close.

He lighted a large torch, and we descended, proceeding by one winding turn after another, some-

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[1] There has been a great deal of controversy on the derivation of this word. The earliest mention of it cited by Du Cange is in the Acta S. Sebastiani, which he attributes to St. Ambrose or some other old author. "Hoc tu dum levaveris perduces ad Catacumbas, et sepelies in initio cryptæ," &c. This passage is curious, as it shows the early distinction between the catacombs and crypts. Du Cange cites several other passages from various authors; among the rest a MS. of the Epistles of St. Gregory the Great (L. iii. Ep. 30), where catatumbas is read for catacumbas, and he supposes cata tumbas to mean ad tumbas, at the tombs, as one would say ad cryptas, ad valles. Probably this may be the right reading; for though we have not any similar word in a classic author, yet Valcknaer cites the word *κατατυμβοχοεω* in his annotations in the Idyll of Theocritus, "The Sicilian Women going to see the Festival of Adonis." See Liddell and Scott, sub voce; see Valck. Adon. p. 324.

[2] See fig. 1, 2 and 3.

[3] See fig. 4, 5 and 6. The sarcophagi in fig. 4 and 5 are open, the covers being lost, in the crypts of St. Hermes they are perfect. See infra.

times ascending and sometimes descending for a very long time. To me it seemed marvellous that he did not lose his way, but he evidently knew every step and almost every tomb, pausing to point out, as we passed, those of the greatest interest.

The atmosphere, as I said before, is close and stifling, and smelling of earth. Not a living thing, not an insect, not even a spider, is found therein. It is, in every sense, the abode of death.

Many stories have been related, and I can readily believe them, of persons who have ventured into these passages without proper guides, and who have been hopelessly lost. In fact, it is said, that as late as the year 1837, the teacher of a school, accompanied by thirty pupils, went into an excavation that happened to be open, stating that among so many it was impossible to lose their way; and that not one of the party was ever seen or heard of from the time of their entering, though every possible search was made by proper persons as soon as the fact was known.

Other tales are related of those who have been so affected by the "gelidus horror" of their situation, the deep burial beneath the earth, in an inextricable labyrinth, and in close contact with a vast multitude of the dead, as to become mad with terror. Nothing can describe these awful solitudes better than the words of St. Jerome, in his commentary on Ezekiel (cap. 40), who says,—"When I was a boy at Rome (A.D. 350), and studied the liberal sciences, I was accustomed, with others of the same age and disposition, to go round on Sundays, and visit the sepulchres of the apostles and martyrs, and frequently to enter into the crypts, which are dug deep in the earth, and on each side of them, to those who enter, they have the bones of the dead for walls, and are so dark as almost to fulfil the saying of the prophet, 'Let them go down alive into hell.[1]'"

Here and there, however, are small chambers, commonly called "cubicula" or crypts proper, of the greatest interest. In them the Primitive Christians are said to have assembled for a species of service, called by Tertullian (ad Uxor. i.) and by St. Cyprian (de Lapsis) συναξις, or gathering together; but this is simply impossible, as out of some fifty or sixty described by Aringhi, and of which he gives the dimensions, the largest is only 15 feet by 7 feet 6 inches: the greater part being only nine or ten palms (about 7 feet 6 inches) square, while those lately discovered by Perret, and published by the French Government, seldom exceed 4½ mètres each way. As has been said before, they are generally cut out of the solid tufo rock. The probability is, they were oratories, or perhaps mortuary chapels. That of St. Hermes, who is said to have been a prefect at Rome, who suffered martyrdom in the time of Hadrian, contains a tomb, which is to this day occasionally used as an altar. It may be convenient to describe this crypt as a type of very many others. It is about 13 English feet in length, by about 6 feet 6 inches in width, and about 8 feet in height, and arched like a barrel vault. It is approached by some steps leading out of one of the mazes of passages before described; it is plastered with a fine intonaco, and filled with paintings as, in fact, a large majority are. The tomb at the end is, in fact, a sarcophagus; the top of which is plain, and the front is sculptured in three compartments. It is supposed there were two bodies buried at the end (besides that of the saint), four on the right side, and four on the left, besides three smaller spaces which probably held the bodies of children. In the centre a lamp has been suspended. This crypt of St. Hermes must not, however, be confounded with the church dedicated to that saint, which is of considerable size; and though now entirely covered over, apparently was originally only partly sunk in the earth, as there are a sort of clerestory windows, which gave light apparently through openings resembling the walls round the area window of our houses.

Boldetti (pl. 2) gives a view of another crypt, which is in the catacombs of St. Agnese. It

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[1] "Descendant ad infernum viventes."

is groined, and on three sides has tombs, which have been used as altars. On one side is a large chair cut in the solid rock, said by him to have been an episcopal seat; by others the seat of priest, while giving instruction to catechumens. Such chairs, however, are not uncommon in these crypts. In one given in Aringhi, vol. ii. p. 81, there are two similar chairs cut out of the solid tufo, and a bench of the same kind which goes round the other three sides of the room. It is said, but on what authority I do not know, that the second seat was for the deaconess, and used by her at the catechising or instructing the female converts. The crypt is, however, but 8 feet long, 7 feet 6 inches wide, and 8 feet high, and has contained eight bodies, besides one (probably) over the door. In addition to those with arched or groined roofs, there are some of which the ceilings are quite flat. The crypt, called the oratory of St. Helena,[1] is of this class; it is supported by four columns each, at a little distance from the wall. Sometimes the tombs were covered by a sort of grating carved in marble, through which visitors might look, and probably view the coffin of the martyr. A very curious one is found in the crypt of St. Calixtus. The grating is of peculiar form, and much like that under the altar at S. Nereo and Achilleo.[2]

It is the opinion of Seroux D'Agincourt, and seems a very probable conjecture, that the idea of these crypts was taken from a species of construction common among the Romans, where a "sacellum" containing an "ædiculum," or shrine, to the tutelary god of the family, was erected over the "columbarium," or place for depositing the urns which contained the ashes of the different members of it. There is one which stands apart not far from the church of St. Agnes. It is wholly of brick, even the capitals of the columns being cut out of that material, and is supposed to be of the time of the early emperors. The shrine of the genius of the family is above, and below is an arched chamber, which was the sepulchre. On each of the four sides of this lower part is a niche, probably intended for the statues or "imagines" of its principal members, and eight other very small niches, each of which contained two urns full of the ashes of the dead. There can indeed be but little doubt, that these Roman structures (which were a combination of the tomb and the oratory) gave the origin not only to the crypts of the ancient and mediæval church, but also to those picturesque tombs now so common in the cemeteries of Italy and France, where the family vault is below, and above is a little chapel, whose grated door displays an altar and crucifix, where the relatives repair at certain times to pray and to suspend crowns of "immortelles" in memory of the dead.[3]

It will not be within my limits to describe the various objects found in these crypts. The greater part, as I have said, contain paintings, some of very great merit: the subjects are mostly from Scripture history. There are also, as might be expected, many rings, coins, lamps, &c. found; plain chalices of mixed metal have also been discovered, probably eucharistic; strange and horrible instruments supposed to have been used for the purposes of torture; phials of glass,[4] in which, it may be new to some to hear, are paintings. M. Perret is said to have made no less than eighty-six copies of paintings on, or rather *in*,[5] glass in the various catacombs. To describe the symbols found on the tombs and the inscriptions would fill many volumes. They comprehend not only sepulchral inscriptions, the history and memory of the dead, pious ejaculations, religious emblems, but in many cases delineations of the instruments of the worldly calling or profession of the departed.

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[1] Fig. 7.

[2] Fig. 9. It resembles half-round tiles placed one over the other, but is cut out of solid marble.

[3] There are several in the Street of the Tombs at Pompeii.

[4] On the side of many of the tombs like that at fig. 2, a small cup of glass is fixed, at the bottom of which is the remains of a dark substance, said to be the blood of the martyr there interred.

[5] These representations appear to have been made on thin sheets of gold, the outlines being partly indented into the metal, which has then been blown into the bottom of the vessel between two thicknesses of glass.

There is one, however, of great interest to the architect, as probably forming the tomb of a mason or sculptor. There are represented the ordinary compasses, callipers, a rule, square, level, mallet, and chisels, and what is more curious, an instrument much resembling a trammel, and which has been surmised to be intended for the delineation of ellipses.

A few words, however, may be said as to the style and date of these crypts. In the admirable work of Seroux d'Agincourt a very curious parallel is given between the pictures found in the Pagan tombs and those in the Christian crypts. The author is inclined to think they range in point of style and date from the second century to the eighth, and in instances at Naples even later. He gives as a parallel the paintings in a tomb discovered by Bartoli near Rome, which is clearly of the time of the Antonines and those discovered in the crypt of Saint Priscilla, which may be said to be identical in point of style.

That many of the paintings in the Christian crypts must be of very early date is also indicated by their still preserving some traces of Pagan emblems. Thus the Muses still exemplify harmony; and for some time Orpheus,[1] with his lyre, attracting the beasts around him, was given as an emblem of our Saviour. This is of frequent occurrence, and being surrounded by Scriptural subjects, as Daniel in the Lion's Den, Moses striking the Rock, the Raising of Lazarus, all prove them not to be the tombs of Pagans, but of Christians; and they also show how the memory of Orpheus was associated in their minds with the idea of the law-giver, the leader of civilization; and, what is perhaps still stranger, to typify the inventor of fine art;[1] for it has been too much the case to represent the early Christians as stern ascetics, for whom poetry, music, art, and architecture had no charms.

Again, the whale swallowing Jonah is just in the style of the dragons on the walls at Pompeii; Elijah departs for heaven in a regular classic quadriga; and the three kings seek the Saviour, each having on the Phrygian cap. On some are representations of persons dining together at a table, not reclining like Romans upon the lectum or bed around the triclinium, but seated in chairs. These we know, from the inscription αγαπη, written on them, must be representations of the "love feasts" of the early Christians. Another curious subject would lead us to believe that the Christians often employed heathen artists, for on one of the tombs the sculptor has probably forgotten and cut the usual Pagan D.M., or Diis Manibus; but has recollected himself, and struck his chisel across the letters, and placed the well-known Christian monogram by its side. These last-cited circumstances, however, prove but little, as the αγαπαι were continued in churches as late as the sixth Council of Constantinople, commonly called the Council in Trullo, which was at the end of the seventh century; and if the tradition as regards the celebrated monogram be correct, the inscription alluded to must at least be as late as the time of Constantine. Of course, without direct evidence, it is difficult absolutely to pronounce on such a point; if, however, we may be allowed to reason from similarity in art, we may believe some of these crypts to be as old as the third if not the second century. The art, however, gives an idea of wealth and refinement among the early Christians, which we are usually taught not to expect at that period. It seems still more extraordinary that they should be permitted so to adorn their tombs. It must have been not only an expensive work, but one which must have taken up a great deal of time, and therefore could hardly have been done, at any rate, to such an extent, without the knowledge of the authorities. It must, however, be borne in mind, that the persecutions broke out at intervals,[2] and then ceased; and, according to the worst accounts, the Christians had peace for more than 140 years out of the three first centuries.

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[1] It is not impossible that the tradition of going down to Hades and returning again may have suggested a further parallel.

[2] The passages above cited from Eusebius seem to show that many of the persecutions were sudden outbursts of savage disposition, rather than prolonged and organized series of cruelty and oppression like some of the later persecutions.

If the internal evidences as to art give us no certain data, those as to architecture give us less. There are no distinctive marks about the construction of the passages, or the arching, or groining of the crypts, that differ from what we know decidedly to be Pagan work. It is true that the details of the capitals in the crypt at S. Agnese, mentioned before, seem to be Classic, but those in another of the same crypts, given by Perret in his magnificent book, seem very late indeed, and can hardly be called Classic work. Still more unlike are the caps of the crypt of S. Pretextatus, given in the same book; they certainly must be referred to a late period; while a corbel in the same crypt, discovered in 1846, is quite unlike anything Classic, but rather resembles Byzantine work.

I fear this long account of the subterraneous world must have wearied my hearers. I must now crave of them,—

> "Though long detain'd,
> In that obscure sojourn, while in my flight,
> Through utter and through middle darkness borne,"

to return to the upper world, and see what effect the objects below had on those above.

My readers will remember the law of the Romans, quoted some time back, on extramural interments. It appears that frequent attempts were made from time to time on the one hand to evade, and on the other to enforce it. Adrian passed a law, fining any person 40 aurei (about £30.) who buried a body in a city. Short as was the time between his reign and that of Antoninus Pius, we find (from Julius Capitolinus) that the latter was obliged to re-enact the same law, and that a few years after Domitian was obliged to do the same. The consequence was, all the Christians, whether martyrs or not, were buried, not only without the city, but also without the pomœrium, or suburbs, as Sidonius Apollinaris (i. 5) tells us. Constantine seems to have been the first buried in a city. Eusebius (Vit. Constan. iv. cap. 71) says he was buried at Constantinople, in the Church of the Apostles; but St. Chrysostom (Quod Christus sit Deus) says "in the porch without[1] the church, so they who wore diadems think it a favour to be buried so that kings are the fisherman's doorkeepers." It will be unnecessary to go through the history in all its points; it will suffice that the Council of Braga (A.D. 563) gave permission for men to be buried in the churchyard in cases of necessity (*si necesse est*), but on no account within the "walls of the church." The desire, however, to lay their bones under a holy roof grew so on men that we find a council at Mayence[2] deciding that "no one should be buried in the church but bishops, abbots, or worthy priests, or faithful laymen;" and at last we find the Council of Meaux[3] (Meldense) leaves it to the bishop and presbyter to settle who should be buried in churches and who should not. The result from that time to the present is well known.

But to return to the other branch of our subject. When the persecution had ceased we naturally find the remains of those who had testified their faith with their blood held in greater reverence day by day. These tombs were first visited by those who dwelt near, and then became an object of pilgrimage to those who lived afar off. Pride of such a situation as the proximity of a holy grave in some, and the love of lucre in others, caused all sort of pretences to be set up to the possession of a martyr's tomb, or relics; and these, like all other possessions, soon became objects of barter or sale. In the "Codex" of Theodosius (lib. ix. tit. 7, de Sepul. Violat.) we find this law:—"Let no one

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[1] Τα προθυρα εξω.

[2] Conc. Mogunt. c. 3. "Nullus mortuus intra ecclesiam sepeliatur, nisi episcopi, abbates, aut digni presbyteri aut fideles laici."

[3] C. 72

move a corpse once buried to another place; let no one take away or make merchandise of the body of a martyr; but, nevertheless, if any of the saints is buried in any place for the sake of venerating him, let them add [or construct] any fabric which they please as a martyrium." That this trafficking in relics of saints and bodies of martyrs had become scandalous, we learn from St. Augustin, who wrote about this time. He says (De Vitâ Monach." c. 28), "The most cunning enemy of souls has sent forth everywhere so many hypocrites in the habit of monks, going about the provinces, without any mission, never fixed, never settled; some selling the members of martyrs, if, indeed, they are members of martyrs; others make broad their phylacteries," &c. &c. This state of things may also be still better illustrated by a solemn canon of the fifth Council of Carthage (A.D. 437). It is the 14th chapter, and the title is, "Concerning churches [basilicis] which are dedicated without the relics of martyrs." The canon runs thus:—"Whereas, altars, everywhere, through fields, or by roads, are set up to the memory of martyrs, in which no bodies or relics of martyrs can be proved to be buried. Let them be pulled down by the bishops who preside over such places, if it can be done. But if it cannot be done on account of popular tumults, let the common people be admonished that they should not frequent such places, so that those who think rightly should not be caught and bound by any superstition." Then certain principles are laid down for ascertaining the truth in such cases, and the canon concludes,—"As to those who, through dreams, and certain vain quasi-revelations, put up everywhere the altars of men, let them, in every manner, meet reprobation."

It is not my intention, nor would it be in place, to go into the history of the increasing reverence paid to the relics of the martyrs. It will be necessary, however, to mention that people were not content that the bodies of holy men should be venerated at their tombs, but a system of removing the relics into different churches now prevailed, which system was called "translation." The earliest mention I have found of this, in the works of the ecclesiastical historians, is in Socrates Scholasticus (lib. vii. cap. 25). He mentions a sect of Novatians, who dug up the body of Sabbatius from the Isle of Rhodes, and conveyed it to Constantinople, and prayed on his tomb. Atticus, the bishop, however, caused the body to be removed (this must have been about A.D. 425). The same author (vii. 44) says that Proclus, about fifteen years later, removed the body of St. Chrysostom, who had been buried at Comana, to Constantinople, and laid it on the left side of the Church of the Apostles. But before this we have long accounts by St. Jerome, of the deposition of the bones of SS. Peter and Paul under the altars at Rome; of SS. Andrew, Luke, and Timothy; and Samuel, the Judge of Israel, at Constantinople. But we have no time to enter into details, which may be found in Baronius, and in the letters of the curious controversy between St. Jerome and Vigilantius. Suffice it to say that in almost every church relics of martyrs were deposited under the altars.[1]

This, at first, was done by simply making an opening under the altar, in which the bones or other relics were deposited, the front of which was closed by a sort of grating carved out of marble. It must be remembered that in the early Basilican church the altar did not stand against the wall, but at the chord of the arc of the bema, or tribunal, on the edge of the raised platform itself; behind which, in the middle of the apsis and against the wall, was the θρονος, or seat of the bishop; and on each side of which were the seats of the presbyters, ranged in the form of a semi-circle. To this day it is so in all churches which claim either to have been erected by the early Christians or re-erected on their foundations; and, to this day, in all such churches, the priest says mass at the back of the altar, with his face towards the people, instead of the opposite method which is usual in other churches.

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[1] Mabillon. Lit. Gall. (1, 9, 4) says no relics were placed *upon* altars till the tenth century.

This place for depositing the relics was called the "confessione," or place where the relics of those who had *confessed* the faith are deposited, and this name is retained to the present day. The simplest and no doubt oldest form is that which was at the church of the Quattro Incoronati (before the alterations), and which was a simple aperture under the altar, about 2 feet wide.[1] Very much like this was that at S. Nereo and Achilleo,[2] which is closed by a curious grating, resembling in design very much that in the crypt of S. Calixtus, mentioned above. At S. Maria in Trastevere,[3] the "confessione" is a sort of small chamber, about 5 feet square, also under the altar. As time went on, the confessione becomes larger, and more and more resembling the crypts in the Catacombs. At St. Maria, in Domnica,[4] it is in reality a small crypt, about 13 feet by 10 feet, and is partly below the floor, and approached by a descent of five steps. In this is a sarcophagus, containing, it is said, the body of St. Ciriacus. At St. Prisca the crypt is still larger. It is a vaulted chamber, about 10 feet by 22 feet: the arch supported on two masses of masonry, strongly reminding us of the Etruscan tombs, behind which are two flights of stairs, of about thirty steps in each. I must now call your attention to two confessiones which partake more of the character of the passages of the Catacombs than of the crypts therein; one is that of St. Marco, (A.D. 336 the Pope, not the Evangelist); this is a sort of passage way, of semicircular form, the extreme diameter of which is about 24 feet: the passage itself is about 4 feet wide. It receives light from the grating under the altar. The other is at St. Prassede.[5] Here the entrance is immediately under the altar, by a descent of eight or ten steps: this leads to a passage about 40 feet long, which branches off into two semicircular passages, much like that at St. Marco. This must have been in existence in A.D. 499, in which year it was restored, we are told, by Pope Adrian, in a life of him, written by Anastasius. A still larger crypt is at S. Martino: this was originally partly supported by a block of masonry, and partly on square pillars, like the Etruscan tombs, and forms in fact a small church, about 45 feet each way. In fact, this is the form the crypt now began to assume. At St. Maria in Cosmedin,[6] it has a nave and side aisles, formed partly by six columns, three on each side, and partly by two solid blocks of masonry, and is about 22 feet by 13 feet. At San Lorenzo it is still longer, about 30 feet by 16 feet, and has four columns on each side, and also a tomb in the centre.

I have thus shown that, as time progressed, the small aperture called the confessione had increased till it became larger and larger, till at S. Miniato, near Florence, and S. Michele, at Pavia, it had lengthened to 60 feet and upwards, and become a second church.

At the close of the paper Mr. ASHPITEL said that there were in this country several crypts which he believed to be of the Saxon era; plain groined chambers, with four columns at the angles. In the Norman era the crypts increased in size, and afterwards were larger and larger, till very many of them were co-extensive with the choir of the church. The early English crypts were very fine and interesting, and of those he might mention that at Rochester Cathedral; and what must have been a still finer example, the crypt under old St. Paul's, which formed a church by itself, and was very nearly half as large as the entire edifice. Here, however, they must stop; for just at the origin

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[1] Fig. 8.

[2] Fig. 9.

[3] Fig. 10. Fig. 11 is the section in this, as in the other section (fig. 12). A represents the altar, B the super altar, C the confession, D the raised floor of the bema or tribunal, E the floor of the nave.

[4] Fig. 12.

[5] Fig. 13.

[6] Fig. 14.

of the decorated style of architecture, when there were no differences on points of religion, nor any cause whatever in the church to account for it, crypts proper suddenly ceased to be constructed, with the exception of some small ones occasionally under a chapter house, or a transept. The early decorated, the later decorated, and the perpendicular periods, presented no instance of a crypt under the choir of any large church or cathedral; at all events, neither he nor Mr. Scott, Mr. J. H. Parker, or other friends whom he had consulted, could cite any example of the kind. This was the more remarkable because, when crypts beneath churches fell into disuse, they became common under secular buildings. Thus there was a large one of perpendicular character under the Guildhall, London, and another under Gerard's Hall; but at present he had not been able to find any reason for their discontinuance under churches; and he should therefore be most happy to receive any information on the subject, as he hoped next session to be able to lay before the Institute some account of the crypts of the Mediæval period.

Dr. Biattoblotzky adverted to the crypts or Catacombs at Naples, Alexandria, and Paris, as analogous to those of Rome. Those of Alexandria he had seen opened, and had witnessed their wanton destruction by gunpowder, from the eagerness of the Turks to obtain the sarcophagi, which were mostly of alabaster, in order to convert them into lime; a species of destruction against which the Institute might do well to raise its powerful voice. The sculptures in those Catacombs presented a similar admixture of Pagan and Christian subjects with those of Rome. The Catacombs under Paris were very interesting, but under the pretence that various persons had been lost in their intricate mazes, and never found again, it was now difficult to obtain access to them; but it would be very desirable if permission could be obtained for the Members of the Institute to explore them, with a view to confirm the remarks of Mr. Ashpitel. The tombs of the kings at Jerusalem were also exceedingly interesting in connection with the subject under consideration.

Mr. Papworth moved a vote of thanks to Mr. Ashpitel for his interesting paper, suggesting that crypts lighted from without, of which there are some interesting though rare examples, might be worthy of notice in the paper which that gentleman had promised them at a future meeting.

Mr. D. Brandon seconded the resolution.

Mr. Kerr called attention to the question of the degree of art displayed by the early Christians in the sculpture on their tombs, these being the only works by which the question of their artistic knowledge and feeling could be determined. He believed that public opinion was right, and that the opinion of Mr. Ashpitel was wrong, inasmuch as there was a total absence of artistic feeling throughout the earliest of these works. It would appear that the early Christians repudiated and discouraged art, and indeed destroyed it wherever they could find it.

Mr. Ashpitel said, it had been his intention simply to confine himself to the collection of all the facts relative to crypts, and this rather as applied to their architecture than their artistic features. It was impossible, however, in spite of any popular ideas or preconceived notions, to shut the eyes to the fact, that in hundreds of crypts which had been explored, and probably in thousands which had not been visited for many centuries, there was, he could almost say, a lavish expenditure of fine art of a very high order for the time; but it was not only so, the tombs of the poor class also showed some taste for decoration. The digger, or "fossor," was sculptured in his tomb with his spade and mattock as he stood in life; the carpenter and mason had the tools of their trades carved in the same way. Sometimes the whole-length figure and sometimes the bust only of the "honesta conjunx" was sculptured on the slab which enclosed her remains; and if nothing else, two rudely carved doves, or a dove and a heart attested the affection that had subsisted between the departed. One main fact was certain, they are all tombs of Christians. The heathens at that time almost universally burned their

dead; but apart from this, the inscription, the symbols, and above all, the numerous pictorial subjects taken from the Old and New Testaments proved the religion of the deceased. It might now be enquired, of what rank was that art? and at about what period was it executed? The art in its general scope strongly resembled that in the Baths and Palaces of Titus, and of the Antonines. The ceilings are vaulted, and, as well as the walls, are panelled out in elegant designs in stucco. The great work of Aringhi, as well as of others who have succeeded him, give a very good idea of the costly and elaborate nature of the general designs, but they are of too small a scale to afford an adequate notion of the power of the artist. This difficulty has now been obviated by the publication by the French Government of the magnificent work of M. Perret. This gentleman had devoted six years to the study of art in the crypts and catacombs. The part already published fills six large volumes of atlas folio; and certainly a great number of the examples, the drawing and colouring contained therein rank very high—if not first, in the very first line. With regard to the period at which they were executed, he could only again refer to the authority of Seroux D'Agincourt, who considers some as old as the second century. Mr. Ashpitel considered that any stranger brought into these crypts for the first time would say, these are the tombs of an art-loving people. Although we know that in other countries the conversion first began among shepherds and fishermen, yet at Rome the Apostle was a man of high intellectual acquirements, and the tradition attached to the history of the basilica would show among the early Roman Christians were many of the exalted and noble. Be this as it may, they had a very striking fact before them, and one which deserved the most serious consideration. Mr. Ashpitel then tendered his sincere thanks to some gentlemen who had kindly forwarded him some particulars of Mediæval crypts, and said he should indeed be grateful if any members of the Institute, or of the profession, would do the same.

The Chairman, with a few remarks on the research and patient labour displayed by Mr. Ashpitel's full and comprehensive paper, put the resolution, which was unanimously carried. The Meeting then adjourned.

ON THE USE OF GRANITE.

By Sir Gardner Wilkinson, F.R.S., Honorary Member.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 18, 1860.

As the question of using Granite for building and monumental purposes has been much discussed, I beg to offer a few remarks connected with it, and to notice a fact which shows at how early a period the ancient Egyptians had watched the effect of atmospheric and other influences on stone; and how wisely they profited by the lessons taught them by experience. They had learnt that earth abounding with nitre, from its attracting moisture, had the effect of decomposing granite, but that, in the dry climate of Upper Egypt, the stone remained for ages uninjured when raised above all contact with the ground. When, therefore, there was a possibility of its being exposed to damp, they based an obelisk, or other granite monument, on limestone substructions; and these last are found, to the present day, perfectly preserved, while the granite above them gives signs of decay in proportion to its contact with the earth subsequently accumulated about it. I am speaking of Upper Egypt, visited only four or five times in a year by a shower of rain; for, in the Delta, granite-remains have been affected in a far greater degree than in the Thebaïd: Nitre abounds there; and it is remarkable that the obelisks at Alexandria have suffered least on the sides next the sea.

The Egyptians seldom used granite as a building stone, except for a small sanctuary in some sand-stone temple; and, in the later times of the Ptolemies, one or two temples were built entirely of granite. But, in the pure Egyptian period, that stone was chiefly confined to the external and internal casing of walls, to obelisks, doorways, monolithic shrines, sarcophagi, statues, small columns, and monuments of limited size, and was sometimes employed for roofing a chamber in a tomb.

The durability of granite varies according to its quality. The felspar is the first of its component parts which decomposes; and its greater or less aptitude for decay depends on the nature of the base of which the felspar consists. Egypt produces a great variety of granite; and the primitive ranges in the Desert East of the Nile, about thirty-five miles from the Red Sea, supplied the Romans with numerous hitherto unknown kinds, as well as with porphyry, which they quarried extensively in that district; but the granite of the ancient Egyptians came from the quarries of Syene in the Valley of the Nile; and from these they obtained what was used for their monuments. It is from this locality that the name of "Syenite" has been applied to a certain kind of granite; it is, however, far from being all of the same nature, and a small portion only of the stone found there is really what we now call "Syenite." Already, at the early period of the IIIrd and IVth Dynasties, between twelve and thirteen centuries before the Christian Era, the Egyptians extensively employed granite for various purposes; they had learnt to cut it with such skill that the joints of the blocks were fitted with the utmost precision; deep grooves were formed in the hard stone with evident facility; and it must have been known to them for a long period before the erection of the oldest monuments that remain—the Pyramids of Memphis, where granite was introduced in a manner which could only result from long experience. Again, in the time of the first Osirtasen, about 2050 B.C., granite obelisks were erected at Heliopolis, and in the Fyóom, and other granite monuments were raised in the same reign at Thebes; from which we find that even then the Egyptians had learnt how the damp earth acted on

granite when buried beneath it; and this interesting question consequently suggests itself:—how long before that time must the stone have been used, to enable them to obtain from experience that important hint, which led them to place granite on limestone substructions?

I have already had occasion to offer some remarks on the mode of treating granite surfaces, which has been so ably detailed by Mr. Bell at the Meeting of the Society of Arts (March 14th); and I have stated that the Egyptians adopted the broad character of ornamentation in sculpturing granite very judiciously advocated by him; I will therefore only add that other good examples of such treatment may be found in early crosses of Cornwall, Devonshire, and other localities in this country; where what has been (rather hastily) called the Runic Knot—a design of entwined basket-work, common also in Italy and other countries; the large scroll pattern, also frequently met with on the same monuments; and numerous massive ornaments in relieved intaglio cut in the thickness of the stone, are instances of a style of decorative sculpture admirably suited to granite.

ILLUMINATED MANUSCRIPTS AS ILLUSTRATIVE OF THE HISTORY OF THE ARTS OF DESIGN.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 18th, 1860.

By M. Digby Wyatt, V.P.

From the invention or introduction of writing in every country of the world to the present date, it has been customary, more or less frequently, as the current of civilization advanced or receded, to embellish manuscript with polychrômatic decoration. Of a practice so steadily maintained in spite of ages of indifference and Vandalism, thousands, and, indeed, I might say millions of specimens actually exist. Fortunately, the intrinsic value of the materials of which such volumes were made, offered no great temptation to barbarian cupidity, and many a precious codex still remains, which stripped ruthlessly of the costly binding which once encased it, has been thrown aside as worthless by the very hand which despoiled it of the covers, or precious capsulæ, under which it was once exhibited to the admiration of the faithful, on the altars or lectisternia of the great cathedrals and churches.

Such memorials of the zeal, industry, piety, and taste, of our forefathers lay claim to our attention on two grounds, apparently different, but in reality the same, viz., their value as illustrations of the history of the arts of design, and the importance of those lessons of experience, which every artist may derive from the study of the beautiful types of form and colour which they present to his notice.

It is the former of these two divisions of the subject which constitutes the leading theme of the present paper; but as it would be comparatively deficient in usefulness if I failed to establish the ultimate identity between the historical and the more strictly practical, I propose to do so very briefly in drawing this paper to a close.

I need scarcely recall the facts, that not only was that which we know as the earliest type of writing the most pictorial, but it was also embellished with colour from the most remote ages. A glance at the pages of Rosselini or Lepsius will suffice to convince us that the monumental hieroglyphics of the Egyptians were almost invariably painted with the liveliest tints; and when similar hieroglyphics were executed on a reduced scale, and in a more cursive form upon papyri, or scrolls made from the leaves of the papyrus, the common flowering rush of the Nile, illumination was also employed to make the leading pages more attractive to the eye. Nor was such illumination peculiar to hieroglyphic characters; it prevailed also, but not to the same extent, in the hieratic and demotic modes of writing. Of such papyri notable specimens may be seen in the British Museum; the most wonderful in existence, however, is the remarkably interesting and graphic illustration of the funeral of a Pharaoh, preserved in the Royal Museum at Turin.

Extraordinary dexterity was acquired in a conventional mode of expressing complicated forms by a few rapid touches, and the life and spirit with which familiar scenes are represented, and ornaments executed, in both the early and late papyri, are truly remarkable. The precise extent to which the Greeks and Romans were indebted to the Egyptians for the origination and use of alphabetic symbols, the learned have not yet agreed upon. They have, however, concurred in recognizing the fact that Egypt certainly supplied the principal materials by means of which writing was ordinarily practised. The primitive books of the ancients were no other than rolls formed of papyri prepared in the following manner;—Two leaves of the rush were plastered together, usually with the mud of the Nile, in such a fashion that the fibres of one leaf should cross the fibres of the other at right angles; the ends of each

being then cut off, a square leaf was obtained, equally capable of resisting fracture when pulled or taken hold of in any direction. In this form the papyri were exported in great quantities. In order to form these single leaves into "scapi," or rolls of the ancients (the prototypes of the rotuli of the middle ages), about twenty were glued together end to end. The writing was then executed in parallel columns a few inches wide, running transversely to the breadth of the scroll. To each end of the scrolls were attached rounded staves similar to those we use for maps. To these staves, strings, known as "umbilici," were attached, to the ends of which bullse or weights were fixed. The books, when rolled up, were bound up with these umbilici, and were generally kept in cylindrical boxes or capsæ, a term from which the Mediæval "capsula," or book-cover, was derived. The mode in which the students held the rolls in order to read from them is well shown in a painting in the house of a surgeon at Pompeii. One of the staves, with the papyrus rolled round it, was held in each hand, at a distance apart equal to the width of one or more of the transverse columns of writing. As soon as the eye was carried down to the bottom of a column, one hand rolled up and the other unrolled, sufficient of the papyrus to bring a fresh column opposite to the reader's eye, and so on until the whole was wound round one of the staves, when, of course, the student had arrived at the end of his book.

Of such papyri I need scarcely remind you that no less than nearly 2,000 were found at Herculaneum, the whole so shrivelled and burnt up as to be susceptible of being opened only at the greatest possible risk of total destruction. By careful steaming, and a variety of ingenious processes, many have been unrolled and displayed. They proved, however, to possess little literary, and no artistic merit.

The first great improvement in book-making, was the substitution of sheets of parchment for the leaves of the papyrus. Necessity was in this case the mother of invention, for Pliny tells us, that owing to the illiberality and jealousy of one of the Ptolemies, Eumenes, king of Pergamus, being unable to procure the Egyptian papyrus, introduced the use of parchment prepared for taking ink and pigments.

The second, and even more important change was introduced, according to Suetonius, by Julius Cæsar, who first divided books into pages. His letters to the Senate were so made up, and subsequently all documents either emanating from, or addressed to that body or the emperors, were arranged much as our modern paper-books are. The volumes so formed were known as *codices*, a term which has been retained to express similar objects during the whole reign of Mediæval Latinity.

Although the rolls to which I have alluded, as having been discovered at Herculaneum, were devoid of embellishment, there is sufficient evidence that many of the classical manuscripts were elaborately decorated. Thus Martial alludes to a bookseller's shop opposite the Julian Forum, in which his works may be obtained, "smoothed with pumice-stone, and decorated with purple." Pliny tells us, that Varro illustrated his works by portraits of no less than 700 illustrious persons, and he assures us that writers on medicine gave representations in their treatises of the plants which they described. Seneca also alludes to books decorated "cum imaginibus." Such were the original classical illuminated manuscripts of the Augustan age.

A distinct class may, however, be recognized of somewhat later introduction into Europe than those in this simple style, founded, no doubt, upon Oriental models. The combination of brilliant colours, with gold upon purple, and other stained vellums, appears to have been derived by the Greeks from India and Persia, and continued to be preferred to the more sober style particularly affected by the Romans during the first three centuries, at least, of the Christian era. The earliest instance of Roman adoption of gold lettering on purple or rose-stained vellum is given by Julius Capitolinus in

his life of the Emperor Maximus the younger. It is therein related that the mother of the emperor presented to him, early in the third century, a copy of the works of Homer written in gold upon purple vellum.

Although evidence is wanting that both styles prevailed among the Romans, the simpler one may be assumed as having been most popular in Italy; as, after the transfer of the seat of empire to Byzantium, scarcely any of the more brilliant class can be traced as emanating from the Roman schools of calligraphy. On the other hand, the simpler style appears to have found but few admirers in Byzantium, since almost all the earliest examples of the skill of the artists employed in the capital of the eastern empire are based upon that more brilliant style of illumination in which golden grounds and conventional ornaments, executed in brilliant colours, form the leading features of decoration. The Roman style may be considered as closely allied in its pictorial elements, originally, to the art of Pompeii and Herculaneum, and, subsequently, to that of the Catacombs; while the Greek style presented, originally, a close relation to Oriental prototypes, and ultimately, to the popular art of the mosaic worker.

I shall briefly allude to a few of the principal existing specimens of each style, since they must ever be regarded as furnishing the best and indeed the only reliable illustrations of the painter's art during those ages in which classical tradition became all but extinguished.

The most important Latin illuminated manuscript known to the student of palæography is unquestionably the square Virgil of the Vatican. This originally contained fifty paintings, five of which are now almost entirely effaced. The text is written throughout with considerable regularity, in capital letters, in black ink, and its only ornaments are paintings of subjects derived from the Ænead. They are executed in body colour, with great spirit, and a very free hand, but are wanting in finish, and in any considerable attention to gracefulness of composition. The whole of the accessories, architectural and picturesque, are purely classical, and the costume, arms, and technical execution are perfectly characteristic of the fourth century. They are not accompanied by any purely ornamental frame-work, but are separated from the text only by plain, narrow, red bands. It is right to notice this, as in almost all manuscripts of Latin origin a similar mode of simple framing of painted subjects may be observed. The two subjects of this series most interesting to architects are those which represent Achates and Æneas inspecting the works undertaken by Dido for the beautifying of Carthage, and King Latinus receiving the ambassadors of Æneas. In the former, masons and other artificers are represented at work, and a curious illustration is given of the primitive crane, worked by a large wheel. In the latter the Trojans approach Latinus, who is seated before a temple with an octostyle portico, the pediment of which is filled with sculpture, and the general architectural character of which is exceedingly clearly defined.

A much ruder series of illustrations of leading incidents in the Ænead is also preserved in the Vatican, in a Virgil, probably, of the fifth century, formerly in the Parisian monastery of St. Denis. The celebrated Terence of the Vatican is a classical manuscript, of little less interest and importance than the square Virgil, being similarly illustrated with miniatures, but of a much ruder description.

So far as ancient texts are concerned, irrespective of illuminated decoration, some of the most valuable now extant are those which belong to the peculiar class of books known as *palimpsests*, that is, books which have been twice written over, the original writing having been, as far as possible, expunged, in order to provide a fresh surface of vellum for receiving later transcripts. The most important of this class was the treatise of Cicero *De Republica*, discovered under a copy of St. Augustine's Commentary on the Psalms, by Cardinal Angelo Mai, the celebrated librarian of the Vatican.

The Imperial Library at Vienna is rich in Roman manuscripts, of scarcely inferior interest to those contained in the Vatican. The most elegant is a calendar, decorated with eight allegorical figures of the months. Although of about the same period as the square Vatican Virgil, it differs from it in containing, in addition to pictorial representations, numerous elegant ornaments of a conventional description. At Vienna is, also, the exceedingly curious manuscript "Dioscorides," a work of peculiar interest in the history of painting, since not only does it contain in its text the earliest allusion to that property of drying which renders *oil* an eligible material for the painter's use, but in one of its miniatures, illustrative of the invention, it shows a scribe writing, and an artist engaged in painting a picture placed upon an easel differing but little from those in use at the present date. In one hand the artist holds his palette, and with the other he is applying the colour to his picture. At his feet is a slab upon which his pigments are disposed for transfer to his palette. The date of this interesting manuscript is fixed by the fact of its containing an elegant portrait of the Empress Juliana Anicia, for whom it is known to have been written at the commencement of the sixth century.

The Ambrosian Library at Milan contains a Homer with fifty-eight pictures, corresponding with those of the Vatican square Virgil. The Laurentian Library at Florence possesses the celebrated Medicean copy of the latter author, a codex much esteemed for the purity of its text, although devoid of illumination. The Paris Prudentius may be said to correspond (with the exception of a difference in the form of the capital letters in which it is written) with the Medicean Virgil.

The purest of the classical manuscripts were written in regularly-formed capitals. The next and less perfect class is that in which the characters consist of what are known as rustic capitals, or those in which the writing is slightly inclined, in a manner corresponding with many of the inscriptions which have been found rudely scratched upon the walls of the houses at Pompeii, and in the chapels and other apartments of the catacombs.

Another variety of writing in capital letters was that known as the *uncial* style, which was the first approximation to a cursive or running hand. These letters generally resemble capitals, but instead of being angular are to a great extent composed of rounded forms. Specimens of this uncial character may be traced in the fourth century, and it appears to have changed little until the seventh. It is in this character that the Dioscorides of Vienna is written, while the later of the two Vatican Virgils already mentioned, and the Paris Prudentius, are in the rustic.

The uncial character, or rounded capital, was a transition to the *minuscule*, or "lower-case" letter, which at length became a distinct character from the alphabet of capitals, the latter being generally known in contradistinction to the *minuscule* as *maguscule;* but whilst a knowledge of the exact sequence of the varieties of character in which illuminated manuscripts have been written is essential to enable us to arrive at any approximation to a correct determination of the age of any such work, I do not propose to dwell upon this branch of the subject here, but rather to confine myself to the illuminations, which have more direct interest for us as artists.

Having adverted to a few of the most important of the simpler class of classical manuscripts, I will now proceed to allude to the principal specimens of the more gorgeous kind, including those known to have been executed in the Eastern Empire, at the same time that those already described were completed in the Western.

St. Jerome, writing in the fourth century, exclaims in a well-known passage, —"Let those who will have old books written in gold and silver on purple parchments, or, as they are commonly called, in uncial letters,—rather ponderous loads than books,—so long as they permit me and mine to have poor copies, and rather correct than beautiful books." The principal volumes still existing corresponding with the description given by this great father of the Church, are the celebrated "Codex

Argenteus," of Ulphilas, written in gold and silver letters upon a purple ground, A.D. 360; the Psalter of St. Germain de Pres; a fragment of the New Testament in the Cottonian Library (Titus, c. 15); and a copy of the Book of Genesis in the Imperial Library at Vienna; the three latter of which are believed to have been executed during the fifth and sixth centuries.

All of these, it may be observed, are in the Greek character, and, with the exception of the Codex of Ulphilas, may be considered as the production of Greek scribes. The only one which contains miniatures is the copy of Genesis, at Vienna, which is illustrated by no less than eighty-eight. These correspond very closely with the paintings which once enriched another celebrated Book of Genesis, which belonged to Sir Robert Cotton, and was almost entirely destroyed in the fire at Ashburnham House, in 1731, which consumed so many irreplaceable relics of past ages. The Cottonian Genesis, as far as can be ascertained from collections made previous to the fire, and from the charred and shrunken fragments which are all that now remain of this precious volume, contained no less than 250 miniatures, each about 4 inches square. These two remarkable versions of the Book of Genesis are supposed to be of nearly equal date, a slight precedence in point of antiquity being conceded to the English specimen. The Vienna text is written, as we have remarked, in letters of gold and silver, while that of the English version is throughout in black. Gold in the English volume is but sparingly introduced in the miniatures; and Dr. Waagen remarks that only the hatched gold upon the borders, the glories, and the lights upon the crimson mantle, indicate the commencement of Byzantine art.

That which is supposed to be the most ancient of all the texts of the Holy Scriptures, the Codex Alexandrinus of the British Museum, is written throughout (with the exception of the first three or four lines in each book which are in *red*) in *black* letters; a slightly ornamented pen-and-ink line drawn at the end of each book being the only decorative feature contained in it.

The libraries of the Vatican, as well as those of Paris, Oxford, and London, contain other specimens of brilliant ancient manuscripts, written in gold and silver letters, for the most part, no doubt, at Byzantium previous and immediately subsequent to the age of Justinian. There can be very little question that an important modification in the character of illuminated manuscripts, and, indeed, of all the arts of decoration, took place during the impulse given to the arts by the important works carried on by command of this emperor during the middle of the sixth century. The relations which existed between the empire over which he reigned, and the ruling powers of Persia, were exceedingly intimate, and there can be little doubt that the fruits of the "eternal peace," which he concluded with Chosroes Nushirvan, in the very year in which the great church of Sta. Sophia was commenced, A.D. 532, may be traced in the golden grounds, the jewelled ornaments, and brilliantly coloured conventional foliage, which speedily and almost completely superseded the traditions of Roman art, which had greatly declined during the interval which occurred between the removal of the seat of empire from Rome to Constantinople by Constantine, in the year 329, and the accession of Justinian, in the year 527.

The most interesting illustration of the participation of the art of illumination in this change we may be proud to possess in this country in the celebrated and unique Eusebian canons, executed on an entirely gold ground, two leaves of which, painted on both sides, are preserved in the British Museum (Addit. MS. No. 5111). Their beauty of colouring is very great, and both in that respect and in the peculiar forms of the ornament by which they are decorated, their divergence from classical tradition, and their affinity to Oriental art, will be at once perceptible. In the more pictorial features, such as the small portraits introduced in circular compartments, they exhibit a mode of painting strictly in consonance with antique precedents, and still retained in tolerable perfection.

To whatever degree this pictorial power might have degenerated from the comparative excellence of classical ages, it is to be remembered that it was far in advance of any other school at that time existing. The social and political convulsions which prostrated the Latin empire before the Goths, the Vandals, and the Lombards, reduced the traditions of the Roman art to an utterly effete condition in the land in which they had once reigned paramount; and it was in the Eastern empire alone that art found protection and comparative tranquility.

While all was dark in Europe, with the exception of the flickering light still casting an occasional ray from Constantinople, a new light was springing up in the islands of the west. The learned have differed in their recognition of the immediate means by which Ireland first became Christianized. It is, however, generally admitted that that change from darkness to light took place at a very early period. That the Irish were in possession of some of the most ancient versions of the Gospels is clear from the texts of their earliests manuscripts, which differ essentially from the version introduced by St. Jerome towards the close of the fourth century. The oldest of these works date from the sixth century, and exhibit a series of entirely original features in the extraordinary illuminations by which they are decorated. Many of their saints were distinguished scribes, while their schools became so celebrated throughout Europe as to be resorted to by students from many distant lands. In the school of Finian, which is said to have included no less than 3,000 scholars, the great St. Columba, or Columbkill, who was born A.D. 521, was instructed in many arts; and in that of illumination he became specially and justly famous. He it was who about the middle of the sixth century, established that celebrated monastery in the island of Iona, or Icolumbkill, which was subsequently transferred under the Irish monk, St. Adrian (635, 651), to Lindisfarne, and whence St. Cuthbert and his learned associates, spread true religion and knowledge far and wide in the north of England. In the library of Trinity College, Dublin, is preserved a precious volume containing an entry of extreme antiquity, relating that it was written by St. Columbkill himself, in the space of twelve days. It is copiously decorated with what Mr. Westwood (who has done more than any other student to spread a knowledge of this interesting school of caligraphy) has designated as "tesselated interlaced ornament." Nor is this by any means a singular specimen of Celtic art of the sixth century, since many other volumes of even greater intricacy and elaboration are extant in Ireland, England, France, Germany, and Italy.

The remarkable diffusion of manuscripts executed by Irish scribes is accounted for by the exemplary efforts of the Irish and early Anglo-Saxon missionaries. Thus St. Boniface, the apostle of Germany, carried with him to that country his precious book of the Gospels, still preserved as a relic, and a highly-prized one, at Fulda. St. Kilian took with him to Franconia books, still preserved at Wurtzburg. In the public library of St. Gall, in the canton of Switzerland which still bears his name, records of the labours of the saint still exist; and not only did these curious volumes help to form the schools of caligraphy which afterwards became celebrated in Germany and elsewhere, but, in the monasteries which they founded, the saints themselves educated scribes to imitate the writings originally brought from Ireland. Thus, as M. Libri, the great bibliographer, has justly observed, "One cannot help remarking that the most celebrated of these pious missionaries, St. Columbanus, laid the foundations at Luxeuil, in France; at St. Gall, in Switzerland; and at Bobbio, in Italy, of three monasteries which afterwards became famous for their admirable manuscripts, in many of which, the influence of the Irish and Anglo-Saxon schools can be recognized at a glance. The Bobbio manuscripts are known by the discoveries which have been made in the palimpsests, which once belonged to that collection. The manuscripts of Luxeuil have been dispersed; but the specimens of them which are to be found in the Libri collection, joined to what

has been published on the subject by Mabillon, O'Conor, and others, prove that in this abbey, as well as in that of Stavelot in Belgium, and other ancient monasteries on the Continent, a school of writing and *miniature* had sprung up, as remarkable for the beauty of its caligraphy as for the care applied to reproduce the forms of the Anglo-Irish schools.

I have seen no manuscripts demanding for their execution greater truth and delicacy of hand than some of these Irish productions, and more particulary the "Book of Kells," a treasure preserved in the library of Trinity College, Dublin, which tradition asserts to have belonged to St. Columba himself. The volume consists of 339 leaves, each 13 inches by 9½ inches. The text is that of the Gospels, and is considered by Biblical students to be a version antecedent to that of Jerome sanctioned by Pope Damasus. In this, like other contemporary books of Gospels, the Eusebian canons precede the sacred texts, and these are written, as is also usual, in arcades. In this respect, and in the conventional attitudes of some of the figures, can be traced their only analogy to ancient Byzantine or Latin manuscripts, from which they totally differ in every ornamental detail. With the exception of certain flat tints, forming the fillings in, the whole of the work appears to have been executed with an extraordinarily fine pen; there is no attempt at any expression of light and shade; the whole is flat, and no graduated tints are introduced. Gold I have never seen in a genuine Irish manuscript, and, although found in some of the books executed in a similar style in England, I do not think that it was ever used in Ireland. The power of depicting the human figure was almost wanting, but occasionally some of the animals occurring in the lacertine combinations of ornament were drawn with an approximation to correct form. The colouring, however, is invariably most conventional in its arrangement. The leading elements of ornament are interlacing bands, terminating in spirals, coiled eccentrically one within another, and interwreathed birds and animals struggling as if in interminable contest. The surfaces inclosed by lines or by ornaments, such as those described, are frequently covered over with geometrical patterns of extreme minuteness, executed by repeated symmetrical touches of a finely-pointed pen, and corresponding occasionally both with the class of ornament exhibited on Chinese and Japanese work, and on the carved woodwork of aborginal races. The most agreeable contrasts of colour in these manuscripts are those of purple with yellow. Considerable life was given to combinations of ornament by enclosing the bounding lines with closely-serried minute red dots. Although small, one of the most elegant of all the Irish volumes is that known as the Gospels of McDurnan, preserved in the library of the Archbishop of Canterbury at Lambeth.

It is exceedingly difficult to predicate, with any certainty, as to the relative ages of the various specimens of Irish illuminated manuscripts, which still exist; as, although some are ruder than others, there is scarcely any alteration in the system of ornament, or the representation of animated objects, to be recognized in the whole series. How profoundly they were admired in the Middle Ages is testified by several citations given by Mr. Westwood; the most interesting perhaps being that of Giraldus, written in the twelfth century. That author describes a book which he saw at Kildare, said to have been written by St. Bridget, who died A.D. 525, and concludes what Mr. Westwood calls his "flaming account" of it by stating that "scarcely could Apelles himself execute similar works, which appeared to have been formed and painted by some scarcely mortal hand."

From the monastery of Lindisfarne, to which I have alluded, the arts taught in the schools of Ireland were communicated to various English monastic institutions, and more particularly to that at Glastonbury. How identical the practice of the scribes, both Irish and Anglo-Saxon, who exercised their art at Lindisfarne was with that of Ireland, may be traced by a comparison of books known to have been illuminated in Ireland, with such works as the Durham Book, or Gospels of St. Cuthbert, and others, which we cannot doubt, were executed in this country.

The last-named volume, probably the most remarkable manuscript in the British Museum, is of world-wide celebrity. St. Cuthbert died in 698, and, by way of a memorial to him, his successor, Bishop Eadfrith, caused this noble volume to be written. It was greatly enriched by Ethelwald, Bishop of Lindisfarne, who succeeded Eadfrith in 721. This prelate caused the book to be richly illuminated by the hermit Bilfrith, who prefixed an elaborate painting of an evangelist to each of the four Gospels, and illuminated the capital letters at the commencement of each book. The bishop caused the whole to be encased in a splendid binding of gold, set with precious stones; and in 950 a priest named Aldred rendered the book still more valuable, by interlining it with a Saxon version of the original, which (unlike the more ancient Irish manuscripts) was in the Latin text of St. Jerome.

The preservation of this elaborate volume is of high importance, as showing that, for at least one hundred years after the advent of St. Augustine in this country, the Irish style of illumination was adhered to in the north of England by Anglo-Saxon students; and that very few traces were manifested in those changes of style which were introduced through the admiration excited by the comparative pictorial excellence of the illuminated books known to have been brought by the envoy of Pope Gregory the Great into this country in the year 597.

These books are known to have consisted of a Bible in two volumes; two Psalters; two Books of the Gospels; a Book of Martyrology; Apocryphal Lives of the Apostles; and Expositions of certain Epistles and Gospels. The Bible, which was beautifully written on purple and rose-coloured leaves, with rubricated capitals, with portions in gold and silver, was certainly in existence in the reign of James I. Some of the learned think that this Gregorian Bible may be traced in the magnificent purple Latin Gospels of the British Museum (Royal Library, 1, E. 6); but a careful examination will, I think, establish the presence in that volume of features so decidedly characteristic of Anglo-Saxon work, as to render it exceedingly unlikely that the volume could have been written anywhere but in this country. There can be little doubt, however, that if not the identical volume, it was one of the earliest transcripts made from it; and probably under the superintendence of St. Augustine himself. In this book of the Gospels the execution of the figures is entirely different from that commonly practised by the Irish scribes. There is an attempt at shading, and there is a sketchiness of touch which appears to me to clearly indicate the attempts of an artist, accustomed only to the use of the pen, to copy the touches and effects produced by means of the brush.

Mr. Westwood, in articles recently published in the *Archæological Journal*, has avowed himself as of opinion that a scriptorium, or school for the production of illuminated books, was established by St. Augustine at Canterbury, almost immediately subsequent to his arrival in this country; and he cites various manuscripts in which the combination of the Irish or earliest Anglo-Saxon style with features derived from classical antiquity, though both Greek and Latin manuscripts, is plainly to be recognized. In these, the writing, initial letters, and interlaced ornaments—lacertine and simply decorative—are altogether Anglo-Irish, or, in other words Early Anglo-Saxon, while the figures and pictorial features are copied from classical models; from their imitation of which there is little doubt the Saxon scribes acquired that free manner of sketching to which we shall presently have occasion to allude, as distinguishing the second class of Anglo-Saxon illumination.

The most notable illustration which I am acquainted with of this combination occurs in the Cottonian Psalter, known as *Vespasian, A.* 1, the principal illustration in which consists of an arcade, formed of an arch and pilasters, ornamented with the tesselation, spirals, and red dots of the Hibernian scribes, and within which King David is seated and playing on the lyre, surrounded by attendants rejoicing and blowing horns and trumpets. The framework is outlined in the hard, sharp-pen style

of a scribe, while the subject is executed in body colours with a free brush, with considerable attention to light, shade, and effect, and a total absence of the hard outline which bounds all the figures in such volumes as the Book of Kells and the Gospels of St. Chad.

Of all the manuscripts known to have been brought to England by St. Augustine, the books of the Gospels are the only ones the existence of which at the present time may be considered as probable. Fragments of a set of the Gospels are preserved in the Library of Corpus Christi College, at Cambridge, the illuminations of which are of the highest interest. The most important of them represents St. Luke, in classical costume, seated under a triumphal arch, supported by four marbled columns, and ornamented just as we might suppose a similar architectural monument would be, by a mosaic worker of the time of Gregory the Great. Hung to, or placed against, the two outside columns supporting this arch, are two square pictures, enclosed with the plain Roman red frame which I have described as a common feature in the more simple style of classical illumination. No ornament recalls the Celtic style in any degree; and there is every reason to believe, from the evidence afforded by the manuscript itself, that it may have been executed at Rome and brought to this country by St. Augustine.

In this case tradition coincides admirably with artistic probability. The above, and another fragment belonging to the Hatton manuscripts in the Bodleian Library, at Oxford, embellished with no other illumination than the contrast of red and black ink, and a few ornaments about some of the initial letters, contain entries in Saxon, written certainly more than 1,000 years ago, connecting them with the library of the Abbey of St. Augustine, at Canterbury; and, furthermore, they correspond with a description given by a monk of that monastery, who, writing in the reign of Henry V, dwells upon the "*primitie librorum totius ecclesie Anglicane*," preserved in that library, as the very Book of Gospels, in the version of St. Jerome, brought to England by St. Augustine.

Considerable interest is attached to the question of the probable nature of the illustrations to the Book of Psalms, brought hither by the Roman missionary, in consequence of the existence of a set of illuminations, such as may have been copied from a classical original, not altogether unlike certain well-known Latin manuscripts, constituting one of the earliest and most ably designed series of illustrations, carried out by Saxon scribes, and executed in that which I have alluded to as the *second* Anglo-Saxon manner. It was the manner, in fact, of scribes giving up purely conventional ornament, and taking to imitative art.

The finest specimen of this transition style is exhibited in the Psalter once belonging to Sir Robert Cotton, and now preserved in the public library at Utrecht. In this volume the text is written in Roman rustic capitals, and in narrow columns, three in a page, both evidences of considerable antiquity; such, in fact, as would place the manuscript amongst those of the sixth or seventh century. At the same time it contains several features common to Anglo-Saxon scribes during the seventh and eighth centuries. The principal illuminations are in pen and ink, without colour at all. The architectural forms, the costume, and many of the details, are completely Roman in style. The figures are drawn with great spirit and expression, but with rather a weak outline. Mr. Westwood, who has examined this Psalter very carefully, observes that the subjects are treated identically in this and no less than four well-known Saxon manuscripts. The classical nature of all the details, and the great popularity of this set of illustrations, justify the belief that they must have been copied from some classical specimen held in high estimation,—from just such a manuscript, in short, as would have been one of the Psalters brought to this country by St. Augustine.

There can be little doubt that several other Anglo-Saxon manuscripts, which have puzzled students, owe their apparent anomaly to the fact of their having been copied by scribes, at various

FROM THE "GOSPELS OF CANUTE" IN THE HYDE ABBEY STYLE.

Day & Son, Chromolith^rs to the Queen

British Museum. Reg. I.D.G.

periods, from early classical originals. Such, for example, as the celebrated manuscript of Cicero's translation of the astronomical poem of Aratus (Harl. MS., No. 617), the miniatures in which Mr. Otley considered so thoroughly ancient in every respect, that he was induced to ascribe the origin of the manuscript to the second or third century. More recent students are, however, clearly of opinion that this manuscript was executed at no earlier date than the ninth century, and that it is a copy from some classical model of the age to which Mr. Otley desired to ascribe the transcript.

There can be very little doubt that to this habit of copying works of classical antiquity, introduced probably into this country mainly through the foreign monks, who rapidly followed in the wake of St. Augustine, must be ascribed much of that graphic dexterity which characterizes the Saxon manuscripts from the commencement of the ninth century to the Norman Conquest.

The third style of Anglo-Saxon illumination is that in which the interlacings, and some of the ornaments of the Hiberno-British school of scribes, are retained, and combined with original illustrations of current contemporary scenes, such as sports, pastimes, incidents of the chase, and agricultural pursuits. Among these, one of the most interesting is the Saxon calendar, preserved in the Cottonian Library (Tiberius, B. 5); and even in this many classical features are to be recognized.

The fourth and the final style is that which we may believe to have been founded, or, at any rate, greatly encouraged, under St. Ethelwold, at the monastery of Mew Minster, or Hyde Abbey, near Winchester. In this style gold was very freely introduced; and, indeed, the charter of King Edgar to the same monastery, granted in the year 966, is written entirely in gold.

The most magnificent specimen of this school is the celebrated benedictional of St. Ethelwold, in the library of the Duke of Devonshire, engraved *in extenso* in the twenty-fourth volume of the *Archæologia*. In the figure subjects, as well as in the ornamental portions of this volume, there is great originality and a delicate harmony of colour, and tenderness of shading, superior to that of any other production of Anglo-Saxon art with which I am acquainted. In this manuscript, and in others,—such as the Gospels of King Canute, the two Gospels preserved at Rouen, the Cottonian Psalter (Tiberius, C. 6), Hyde Abbey Book, late in the Stowe Library, and the Gospels at Trinity College, Cambridge,—the text is generally enclosed within a rich framework, formed by wide and solid bars of gold, about and over which twine elegantly-shaded masses of conventional foliation.

I have dwelt upon these British manuscripts, because they are of high national interest. To the architect they are of great importance, since they afford almost the only completion of the picture, of which some faint traces are presented in the scanty remains of Anglo-Saxon structures.

Mr. Thomas Wright, in an interesting article in the first volume of the "Archæological Journal," has dwelt upon the valuable illustrations of Anglo-Saxon architecture which are contained in illuminated manuscripts; especially in those of the end of the tenth and the beginning of the eleventh century. In one of these (Cotton. MS., Claudius, B. 4), a fine copy of Ælfric's translation of the "Pentateuch," he has carefully examined the pictures, which contain a great mass of architectural detail. Among the most frequently recurring features are arcades, carried upon columns, and the arches occasionally surmounted by pediments. Triangular-headed doorways, and baluster-shaped columns are frequently represented. The doors are shown with iron-work of an ornamental description, and the capitals of the columns are frequently covered with foliage of graceful forms. "Polychromy," says Mr. Wright, "is observable in all the architectural subjects throughout the manuscript. The arches, and even the mouldings and different parts of the columns, are painted of various hues. The colours most frequent are yellow and blue. It may, perhaps, be doubted how far we may depend on the truth of the colours employed by the early artists, for in some instances they seem to be extremely fanciful. I have met with pictures in which men's hair was painted of a bright

blue, but it is not impossible that at some period it may have been the custom to stain the hair of that colour. However, be the colours true or not, these drawings appear to establish the fact that the Anglo-Saxon buildings were painted in this variegated manner." As the result of his comparison, Mr. Wright finds that almost all those structural features which ecclesiologists have recognized as Anglo-Saxon, in contradistinction to Norman, are represented, rudely perhaps, but not inaccurately, in the manuscript.

In respect to the point so much mooted of late,—the date of Waltham Abbey,—Mr. Wright observed, in another Anglo-Saxon manuscript,—the Prudentius of the British Museum (Cotton. MS., Titus, D. 4), written apparently about the middle of the eleventh century—two rows of columns, of which the shafts are ornamented in the same style as some of those which still remain in Waltham Abbey. On this and on other grounds he is inclined to recognize in the existing remains the real church of Harold, or, at any rate, a considerable portion of it. He thus sums up the nature of the evidence as to Saxon architecture to be derived from Saxon manuscripts: "We have, then, in the manuscript under consideration a series of architectural drawings, which are pure Saxon, and of the date of which there can be no doubt. They present a number of characteristics which are sufficient to distinguish a peculiar style, which probably was the general style of Anglo-Saxon buildings. It is certain that the old artists produced nothing on parchment which was not modelled on what really existed before their eyes. I would add that, although illuminated manuscripts, became more numerous after the Conquest, I never met with one of later date exhibiting any of the peculiar characters mentioned above. We find a similar style on parts of existing buildings, which are evidently of a very early date, and which, therefore, as it appears to me, we are justified in attributing to the same age as the manuscript; in the same way that we should ascribe an unknown effigy to the age in which its costume is found to prevail in similar illuminations."

If the character of Anglo-Saxon architecture and sculpture agreed with the representations of both given in the Benedictional of Ethelwold—as I have every reason to believe it did—it must have been massive and elaborate in the highest degree; and there is no reason to suppose that a people who were capable of drawing so well as they assuredly could, should have limited their productions in the sister arts to the rude and clumsy, long and short, and other similar work, which we are in the habit of supposing, characterized all their principal productions.

While such progress in the art of illumination was made in the extreme west of Europe, but little novelty was introduced in the studios of Byzantium. The brilliancy and harmony of colour, which were developed in the age of Justinian, were never subsequently surpassed. That agreeable composition in figure subjects, which remained as the last relic of antique art, became gradually lost sight of, and in weak action and attenuated forms the saintly personages of the principal Byzantine manuscripts degenerated into complete mannerism. In technical excellence, however, Greece long retained its superiority, and that which had been at first an art of uncertain result, finally became a well-regulated process of manufacture. Occasionally, and more particularly about the era of the Norman Conquest, figure subjects of great excellence were executed at Byzantium, both in marble, in metal, in ivory, and in painting on wooden tablets, and illuminated manuscripts.

The advance towards excellence which should have followed after the introduction of so many original Oriental features into Greek illumination of the age of Justinian, was cruelly interrupted by the iconoclastic troubles. Under Leo the Isaurian, A.D. 726, multitudes of skilful workmen and artists were forced to take refuge in the monastic establishments of all Europe. Their settlement in the convent of Sta. Maria in Cosmedino, at Rome, led to the foundation in that capital of the famous *Scuola Grecca*, and gave a vast impetus to the execution of mosaic work and the production of

pictorial embellishments, both on walls, on panels, and in books. On the cessation of those persecutions in the middle of the ninth century a revival appears to have taken place in Greek art, no doubt coincident with the return to their native country of many of the descendants of those who had been exiled in the early stages of the persecution. Under Basil the Macedonian, A.D. 975, and indeed until about the year 1200, many beautiful ornaments were painted upon gold grounds, and lessons of no mean degree of beauty in ornament were set to the Russian, Syrian, and Armenian illuminators, who always closely followed the precedents communicated to them from Byzantium.

Contemporary with the development of the Irish school of illumination, there prevailed in Central Europe a style of considerable rudeness, compounded of the ornamental features affected by the Irish and Anglo-Saxon scribes, the traditions of ancient art still prevailing in some of the principal Roman settlements, and an odd sort of originality which may be best designated as *Frankish*. In this concrete style the few books illuminated for the magnates of the Merovingian dynasty were executed, and it was to convert that comparatively barbaric style into something better corresponding with his accumulated dignities that Charlemagne enlisted in his services the best artists that he could procure in Italy and elsewhere, and engaged our own much-honoured Alcuin to take charge of a scriptorium which he founded at Aix-la-Chapelle, and of that in the Abbey of St. Martin, at Tours. It was in that "Paradise," as the Saxon sage describes it in one of his letters, that all the latter years of his life were dedicated to the superintendence of correct and beautiful transcripts of the Holy Scriptures, and other precious books for the honour and satisfaction of his friend and affectionate patron; and the books produced under his auspices are among the most precious monuments of caligraphy still existing.

Among the most important of these are the Gospels of St. Medard de Soissons,—so called because believed to have been presented by Charlemagne to that abbey, and now probably the greatest lion of the Bibliothèque Impériale at Paris. This magnificent volume exhibits just what might have been expected from the condition of the art of illumination at the period; that is, a style of grand initial letters and complicated ornaments of an interlacing kind peculiarly Saxon, combined with a series of figure-subjects painted with a free brush in body colour, and completely in the antique style. One can, therefore, readily believe that in the execution of the *ornament* and *caligraphy* generally, the most skilful Anglo-Saxon artists were employed, while for the execution of the *figure-subjects* the talents of painters learned in all the arts of Byzantium and of ancient Rome were enlisted.

In addition to the Gospels of St. Medard, among the magnificent volumes produced for Charlemagne may be enumerated an Evangeliarum, long preserved in the Abbey of St. Servin, in Toulouse, and presented to Napoleon I. on the baptism of the King of Rome. From contemporary entries this appears to have been completed after eight years' labour in 781, by the scribe Godescalc. In the same list we must include the Vienna Psalter, written for Pope Adrian, and the Gospels of the Library of the Arsenal at Paris, formerly belonging to the Abbey of St. Martin des Champs, the forms of which are principally Saxon, although the colouring, which is mainly restricted to gold, purple, white, and a little very brilliant vermillion, are on a purer and more elegant scale than is usual in contemporaneous productions. That which is known as the Codex Aureus we preserve in England in the Harleian collection. A somewhat similar volume was found upon the knees of the emperor on opening his tomb at Aix-la-Chapelle; and last, not least, as the production of his era, if not completed in his life-time, we may reckon the celebrated Bible known as that of San Calisto, preserved in the Benedictine monastery of that Saint at Rome. This is by far the most magnificent illuminated volume I have ever seen. It contains no less than 339 pages, and is one blaze of gold and colour from the first page to the last. It is no less in size than 16 inches high by

13 inches wide. The large initial letters are quite Saxon in form; the borders, of which there are endless and beautiful varieties, are more strictly classical in character than is usual in Caroline manuscripts, and the pictures are in an indeterminate style between Greek, Latin, and original Frankish; in that style which, under the descendants of Charlemagne, grew into the peculiar type of twelfth-century work—the progenitor of the pure Gothic of the thirteenth.

Time will not permit my dwelling upon the chief monuments of this transition. I cannot, however, pass over the Bible of Louis le Debonnaire, his Gospels, and the Sacramentaire de Metz; which differ in some degree, although they correspond in general magnificence, with those executed for Charlemagne. The Bible of Louis le Debonnaire is, however, in that Frankish and semi-barbaric style on which Alcuin and others improved.

The manuscripts written for the grandsons of Charlemagne are remarkable for their splendour and curiosity. Thus the Gospels of Lothaire were written and decorated at the Abbey of St. Martin, at Tours, as were also the two celebrated Bibles executed for his brother Charles the Bald,—the one known as the Bible of St. Denis, and the other as that presented to the monarch by Count Vivien, abbot of St. Martin. In these, as in the manuscripts executed during the lifetime of Charlemagne, the ornament is unquestionably characteristic of the Hiberno-Saxon school, intermixed with both painting and ornament derived from classical models.

The scriptorium founded under Alcuin at the Abbey of St. Martin, at Tours, was speedily rivalled by corresponding establishments in other localities; and thus from the Abbeys of St. Martial, at Limoges; from Metz, Mans, St. Majour, in Provence; Rennes, St. Germain, and St. Denis, at Paris, issued, from the age of Charlemagne to the thirteenth century, an uninterrupted series of highly illuminated volumes, a sufficient number of which remain to enable us to trace the progressive development of that expressive and original style which attained its greatest power in the early part of the thirteenth century.

Many Byzantine features were brought into French illumination through the schools of St. Martial's and other abbeys of Limoges, and all illumination produced in the south of France shared in the impulse which French architecture received from its adoption of many of the peculiarities of Eastern origination. It was at Paris, however, as we might readily suppose, that the most rapid change from mannerism to originality was effected. Thus, at St. Germain and St. Denis were produced, during the first half and middle of the eleventh century, two volumes, still existing in the Imperial Library of France, which distinctly show the germination of Gothic. The St. Germain "Mysteries of the Life of Christ" are illustrated by many original and very spirited outline compositions, some of which are slightly coloured; while the missal of St. Denis displays that peculiar grace and *naïveté* in the action and expression of the figures, together with that soft elegance in foliated ornament which for several centuries remained dominant excellencies in the best French illuminations.

It is but just to mention the reaction which took place upon Anglo-Saxon and English illumination from the improvements imported into the art under Charlemagne and his successors, and through the original vigour displayed in these already characteristic Gothic compositions. In fact, we have every reason to believe that, distracted by the invasion and final ascendancy of the Danes, and ultimately by the descent of the Normans, Saxon illumination almost entirely died out in the country in which it had been propagated. So shortly after the Norman Conquest as the year 1091, Ingulphus, in alluding to the fire which destroyed the noble library of his abbey at Croyland, states that the juniors in his monastery were unable to decipher the Saxon character, that letter having been as he says, "for a long while despised and neglected by reason of the Normans, and now known only to a few of the more aged."

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Nos 1, 2, & 3, FROM THE HARLEIAN M.S. No 76
Nos 4, & 5. FROM THE EGERTON M.S. No [illegible]

Day & Son, Chromolith.rs to the Queen

That section of the French nation which acquired power in England afforded by no means good specimens of the lettered Frank; and, under its auspices, the development of a new style, in place of the extinguished Saxon, was but tardy. With the accession of the Plantagenets, however, in 1154, and the marriage of Henry II. with Eleanor of Guienne, the best French influence acquired a marked predominance in English illumination; and for nearly 100 years from that date, the progress in England and France was parallel and almost identical. And here it is but fair to the Dominicans and Franciscans to recognize the extent of the influence exercised by them in consolidating the Gothic elements which took the place of the gradually disappearing Romanesque features.

As the styles of architecture varied in England and France,—agreeing in leading particulars, but each acquiring for itself a set of distinctive characteristics,—so did the art of illumination. In the purely Gothic work, such as prevailed from 1250 to 1400, extreme *finesse* in execution, tenderness of colour, gentleness of expression, piquancy of ornament, and elegance of composition, may be regarded as almost invariable attributes of French productions. In England, on the other hand, the style was not so harmonious but more vigorous, the colouring was fuller and deeper, the action of the figures more intense, the power of expression more concentrated, and reaching occasionally in its energy almost to caricature, the sense of humour always freely developed, and a more generally active sentiment of life impressed upon design, not only in figure subjects, but in ornament. In the latter, monkeys and other animals, dragons, and comic incidents, are very frequently intermingled with graceful foliage and heraldic embellishments. In fact it is to the credit of both countries that, with so much that is excellent in common, they should still have displayed such free and distinctive features as marked the works of each respectively. About the year 1400, in both countries the mechanical reproduction of the accredited types and leading incidents of Scripture and of Catholic faith began to be abandoned; and, mainly from the necessity of giving to the historical personages introduced in secular romances and chronicles individual force and vigour, an attention to portraiture and a transcription of characteristic traits of active life are freely developed.

Considering how few traces of the art of painting, as exhibited either in panel pictures or in mural embellishments, remain to attest the condition of the arts in England and France in the thirteenth, fourteenth, and fifteenth centuries, it is impossible for the student of Gothic art to overestimate the extreme interest which attaches to the chronological series of specimens of the painter's art which may be examined in the great metropolitan libraries of either country. It is very fortunate for our reputation that we are enabled, through so large a series of volumes as still exist, to trace such distinctive and national characteristics as enable us to assert, without fear of error, that so far as graphic dexterity is concerned, the English artificers were fully competent to execute all the artistic productions which have as yet been found upon our soil. That foreigners were freely employed there can be no doubt, but that the works which were executed by them could not have been executed by Englishmen, no one can with safety assert, who has traced with any considerable care the gradual development of English art through a series of English illuminated manuscripts.

The most perfect production of the English school is, so far as I have been able to discover, the celebrated book known as Queen Mary's Psalter. It appears to have been executed about the year 1320, for a member of the Willoughby family. It contains 320 leaves, and is filled throughout with illuminations, which Professor Waagen deliberately regards as the reflection of a larger school of painting. "Upon the whole," he states, "I am acquainted with no miniatures, either Netherlandish, German, or French, of this time,—by no means so favourable to art as the thirteenth century,—which can compare in artistic value with the pictures executed by the best hand in this manuscript. The artist here displays equally in subjects which require a strict architectonic

disposition as in those admitting a freer arrangement, a most correct feeling for the disposition of subjects in a given space. The motives are not only true and animated, but very free, and frequently uncommonly graceful, and in the heads the moral expression is very rightly indicated. The proportions are slender, the drawing of the nude (the period considered) unusually good, and the hands especially of excellent action. In the draperies, it is true, the Gothic, somewhat conventional manner predominates, though treated with refinement and excellent taste." The Doctor recognizes what must, I think, strike any unprejudiced observer, the coincidence of the lightness and freedom with which these designs are expressed with that which may be remarked in both the second and fourth style of Anglo-Saxon miniatures.

The impulse given by the Emperor Charlemagne to French illumination, found a rival at a later date in the school instituted in Germany, under the auspices of the Emperor Henry II. (1002–1024), of which many interesting examples are to be met with in the libraries of Bamburg and Munich. Shortly previous to the accession of that monarch, St. Ulric, Bishop of Augsburg, who died in the year 973, had paved the way for this improvement by himself decorating several copies of the Gospels with miniatures, in which Byzantine influence is apparent, and with ornaments already exhibiting a very pure taste. One of these is preserved at Munich, and another in the Harleian Collection, No. 2970. It is, in fact, in the full development of that ornament which we generally know as Romanesque, and which was of a nature far more complicated than that commonly recognized in this country as Norman, that the greatest amount of originality, and the highest perfection was attained in German illumination. The artists of Germany early converted these Romanesque forms, at first highly conventional, into a quaint reproduction of the more natural features of growing and convoluted foliage, and introduced those crinkled ornaments the mannerism of which subsequently, in their more completely Mediæval specimens, proved a considerable stumbling-block to their arriving at the graceful elegance attained in the best specimens of French and English illumination. Their miniatures, in later examples, reflect the peculiar angularities of the early German school of painting, and through the influence which they exerted upon the Flemish masters, tended in no small degree, to popularize that greatly increasing spirit of naturalism in art which, during the fifteenth century, displaced the purer Gothic, and more ideal elements of the preceding century.

The improvements in pictorial art introduced by the school of Van Eyck proved a fruitful source of excellencies for Flemish illumination, which, under Philip the Bold, Duke of Burgundy, arrived at the highest perfection, and exerted no slight influence upon the miniature painters and illuminists of England and France. Jean Duc de Berri, brother of Charles V, and the Duke of Bedford entered into a keen competition with the great Burgundian. Of the library of the former his Psalter, two Prayer-books, and copy of the "*Mervailles du Monde*," in the Imperial Library at Paris, and of the latter the celebrated Bedford Missal, in the British Museum (mainly, no doubt, the production of Flemish artists), exist to attest the perfection attained at this period.

Whether the increasing popularity of the art of illumination in Western Europe induced all those artists who had preserved any of the traditions of ancient art to quit Italy and to take service under more liberal patrons than they could find in that country, or whether the frightful internal convulsions which distracted that soil gave the death-blow to the art in the capital of Christendom, certain it is that little or nothing remains to testify the proficiency of the Italian scribes in this branch of art from the ninth to the end of the twelfth century.

At the commencement of the thirteenth century, however, some few Italian specimens are to be found, and by the beginning of the fourteenth we meet in the writings of Dante with a commemoration of the talents of Oderigi, the contemporary of Cimabue, and of those of his pupil and successor, Franco

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Day & Son, Lithrs. to the Queen.

FROM A M. S. (REG. I. C. VII)
CONTAINING THE BOOKS OF JUDGES, RUTH & JOSHUA
In the British Museum

Day & Son Chromolith^rs to the Queen.

FROM A MISSAL IN THE
"JEAN DE BERRI" STYLE

British Museum, Harleian MS 2900

of Bologna, who was contemporaneous with Giotto. Vasari bears testimony to the talent of Franco, with whose works he appears to have been well acquainted.

I might multiply the names of the successors of these distinguished artists to a great extent, and, if time permitted, dwell on the skill of those distinguished masters by whom the splendid series of choral books were executed which remain at Sienna, Ferrara, Perugia, and elsewhere, to attest the rare merits of these brilliant illuminators. But from the revival of painting in Italy, pictures, both on *tavola* and in fresco, so greatly abound, and are so well known, that I cannot but feel that, however interesting a specification of their peculiarities and merits might be, enough exists in more important monuments than illuminated books to illustrate the history of Italian art.

The same remark applies with equal cogency to those exceptional artists who in the various countries of Europe continued to practise, and some of them with extraordinary success, the art of illumination as a luxury, long after the invention of printing and the popularization of painting had ceased to render their works labours of necessity. There are, however, among these Italian masters, three whose merits were so transcendent, that no sketch, however slight, of the history of illumination, could approach completeness without a passing allusion to their exquisite productions.

For the great families of Italy,—the truly princely patrons, such as the Sforzas, the D'Estes, the Medici, the Gonzagas, the Strozzi, and the Visconti,—the best artists were constantly employed in decorating both written and printed volumes, in which portraiture is freely introduced, and picturesque and historical subjects are represented with great vivacity, and attention to costume and local truth.

Among these artists, at the end of the fifteenth and during the first half of the sixteenth century, no one was more celebrated and excellent than Girolamo dai Libri. Vasari's description of the talents of this celebrated Veronese gives so lively a picture of the then popular style, that I am tempted to translate it:—

"Girolamo executed flowers so naturally and beautifully, and with so much care, as to appear real to the beholder. In like manner he imitated little cameos, and other precious stones and jewels, cut in intaglio, so that nothing like them, or so minute, was ever seen. Among his smallest figures, such as he represented on gems or cameos, some might be observed no larger than little ants, and yet in all of them might be made out every limb and muscle, in a manner which to be believed must needs be seen."

This extreme delicacy of individual imitation was not confined to Italy, but found most zealous votaries in France, Spain, England, and Flanders. In France especially, the artists employed upon the celebrated "Hours of Anne of Brittany," carried to extreme perfection this almost microscopic style of miniature painting.

Among the principal claims of Girolamo to our respect must be regarded the fact of his having been the instructor of the still more celebrated Julio Clovio, who was born in 1498, and is believed to have died in 1578. Adopting in his ornaments the general characteristics of Girolamo's compositions, which he worked out in tenderer colour, and in his figure-subjects with a miniature Michelangelesque pose and drawing, Julio Clovio executed for Clement VII, and his successor Paul III, a series of masterpieces, such as it would be impossible to even indicate in such a paper as the present. Fortunately we possess two fine specimens of his skill, one in the Soane and the other in the British Museum, both tolerably accessible. Others are, I believe, in various private hands, but I am able to produce for your inspection this evening two copies from the miniatures in the Soane Museum of the greatest possible accuracy and beauty. They were prepared under the super-

intendence of Mr. Owen Jones, and have been reproduced in chromo-lithography with the utmost perfection in his and Mr. Noel Humphrey's splendid work on illuminated books.

Julio's successor in the office of illuminator to the Papal chamber was an artist of not quite as great strength and brilliancy as his predecessor, but one who was endowed with a keener sense of elegance and harmony. Apollonius de Bonfratellis de Capranica surrounded subjects usually taken from the incidents recorded in the Holy Scriptures, with borders of the most glowing colours, in which are introduced compartments, with small figures touched with extraordinary delicacy and skill. I have never seen any more glowing and brilliant specimens of late Italian decoration, such as might be most fittingly introduced in combination with good Italian architecture, than are exhibited in the elegant compositions of this master. Many beautiful specimens of his works were brought to this country in the year 1825, by the Abbate Celotti, from whom they passed into the collection of the late Mr. Rogers. Apollonius does not appear to have worked later than 1572. After the cessation of his labours, however, the Apostolic Chamber appears by no means to have relinquished the employment of an official illuminator, as elegant illuminations continued to be produced down to certainly within a few years of the commencement of the eighteenth century.

I have now run over, at what you will, I fear, consider too great a length, although at the same time far too rapidly for the interest of the subject, the principal historical characteristics of the art of illumination; enlarging upon its features at those epochs upon which additional light is most needed for the illustration of the history of art, and condensing my theme into extreme tenuity at those periods in which more important monuments are sufficiently abundant to require but little collateral illustration from subsidiary arts. It remains, therefore, for me only now to touch upon the practical lessons which must, I believe, follow as inevitable sequences from the historical incidents I have endeavoured to indicate.

The most obvious of these is the coincidence with, and proper subjection to, the major arts, of those which must always be regarded as minor. The miniature ornament of every period reflects on a diminished scale, and frequently in a highly concentrated form, the leading spirit which pervades the greater revolutions of monumental art. Owing to the licence which the diminished scale afforded, the imagination of the artist in these works was restricted by none of those material impediments which, in the execution of the major monuments of art, protracted the realization of the changing fashions of the day, frequently until long after the period when the original impulse may have been communicated to the art in which those variations were possibly but transient fluctuations.

Thus it is that in these relics of the past may frequently be traced artistic impulses destined to find no other embodiment than the form in which they are presented to us in the pages of a manuscript. The copiousness, then, of such documentary illustrations of the invention of remote periods is one of the most valuable features of the teaching they should convey to us. No revival now-a-days of any historical style by the architect can be satisfactory which is not based upon a knowledge, not of the purely architectural features of the period alone, but of the condition and characteristics of all those decorative details which distinguished it as a living reality from the effete and denuded relic which may now only present itself for our information. Thus even the Saxon and Romanesque styles of architecture may, through the architect's careful attention to the decorative features exhibited to us in the pages of ancient illuminated books, be revived, not in their rude and structural nudity, but as glowing with those colours, and decorated with those forms, which we may observe as peculiarly affected in the ornamental and pictorial embellishments of the best artists of the days when those styles were the only ones popularly adopted. And not only are the beautiful ornaments and decorative features of illuminated manuscripts valuable as supplying us with correct information as to the system

of embellishment regarded by the best artists of each period as harmonizing most perfectly with the structural styles prevalent in their days; but in the measure of their permanent beauty they are no less valuable to us as indications of what is excellent for all time.

Thus, then, they may be used, either as enabling us to restore the most brilliant features of the historic styles with an accuracy to be acquired from no other sources of information, or they may be regarded as providing us with materials for that more extended system of eclectic selection which must afford the only basis of perfection and originality in any styles which we may desire now or hereafter to originate; and the origination and perfection of which we may desire to bequeath to succeeding generations, as testimonies that, in the nineteenth century, there lived men as capable of the creation of beauty as any whose happiest inventions are to be found in the pages of these ancient and most precious volumes.

The Chairman (C. R. Cockerell, R.A., President) invited the remarks of the members on the multitude of facts, and the complete chronology of the beautiful art of illumination, which Mr. Wyatt had brought forward.

Mr. Burges, Fellow, stated, with regard to the old purple and rose-coloured manuscripts, that, in a manuscript by Theophilus, he found a reference to the dyeing of ivory knobs, by means of madder and vinegar. It had occurred to him that what would dye ivory would dye parchment; and he made an experiment with some tube rose madder, as prepared by Messrs. Winsor and Newton, and mixing it up with white vinegar, he produced upon vellum a most beautiful rose tint, going right through the skin, and exactly resembling the old work. The art of illumination could not perhaps be extensively revived, but he thought there was no reason why the Service Books of our cathedrals should not be illuminated by our best artists, and urged that such volumes presented to a cathedral church and beautifully bound in gold and silver decorations, would form more appropriate memorials of the departed than bronze statues. Beautiful as the chromo-lithographs now executed were, they fell far short of the beauty of the original colours, raised as they were from the surface. This applied especially to gilding; the gold of the original manuscripts might be compared to sun-beams, whereas in even the best chromo-lithographs that brilliancy was lost, and there was altogether in the latter an entirely different tone and gamut of colour. If fine illuminated books were now produced, and illustrated in their best style by such artists as Mr. Dyce and Mr. Herbert, they would be more and more admired, and be handed down to posterity with as much veneration as the celebrated Durham Book.

Mr. M. Digby Wyatt said that the celebrated purple colour of the Imperial and most precious manuscripts had been proved to have been derived from madder, which the Greeks obtained from a plant that was grown near Athens; Theophilus called the colouring matter "folium;" and the Western nations got it from a plant called Norma or Gorma. Theophilus also stated that it was the practice of the scribes to cover the vellum with an albuminous surface, to protect it from the action of the air; and in that way the purple colour had been preserved.

Mr. Burges said that his own experimental specimens had not faded at all.

Mr. T. H. Lewis, Hon. Sec., said that he had made many experiments with a view to imitate the old gold work, but he could never succeed in getting it anything like the old, which almost resembled plates of the metal itself, and this notwithstanding he had carefully followed the old recipes, many of which were given us in great detail by Theophilus and other writers.

Mr. M. Digby Wyatt said there were many old treatises describing the processes of illumination. Among these were, a treatise published by Raspe in his "Elements of Oil Painting;" another by

Muratōri in his work on the "Mediæval Antiquities of Italy" (which gave curious particulars, probably Greek, as to the preparation of the gold), and also an English manuscript in the possession of Sir Thomas Phillipps of Middlehill, which gave many curious recipes for putting on the gold; but he was free to confess with Mr. Lewis that none of them seemed likely to give results equal to the old specimens. Indeed the best attempts he had seen were in some old sketch books of his friend and quondam pupil Mr. Burges. The Italians habitually, the French occasionally, and the English rarely, used the white of egg or size mixed with plaster of Paris, and that seemed to give the most successful result. The English ground was usually of a reddish nature. The under-coating was, generally speaking, a preparation of vermilion with size. It was probably covered over with *bol ammoniac* to soften the ground, and the gold was then laid upon the top. A slight elasticity was thus produced, which assisted the speedy burnishing of the gold.

Mr. Burges thought the problem would be solved if there were any necessity for it. Two methods were formerly employed; first the "gesso" ground, which occurred in the Shrewsbury Book, &c., and next the opaque ground alluded to by Mr. Wyatt. This he suspected was almost the same as that used by picture-frame makers in burnishing gold size on picture frames. They in fact used both methods. [Mr. Burges detailed the processes and materials employed.] Mr. Hewitt, who had worked a good deal in the British Museum, possessed a mode of gilding, which he made a great mystery of; simply saying that it was made by a composition of three vegetables, leaving thus so large a margin for speculation that his secret could not be found out.

Mr. R. R. Rowe, Fellow, observed that the old missals were not executed by contract, and that the gold leaf then used was thicker than that employed in the present day. He had examined some specimens at Cambridge, in which the gold had come away from the parchment, and he found it much thicker than that now used, and consequently better adapted to bear the pressure of the burnisher, and to give that fine glossy appearance which could not now be obtained.

Mr. M. Digby Wyatt observed that some of the old manuscripts were really executed by contract, and read the heads of contracts entered into in the year 1346 for the illumination of a Psalter, a Hymnal, and a Collectary, copied from the Fabric Rolls of York Minster.

Mr. Kerr, Fellow, in moving a vote of thanks to Mr. Wyatt, adverted to the large amount of learning which the paper displayed, and the minute knowledge which had enabled him to communicate to them so readily such a large amount of valuable information.

The President joined in cordial recognition of the knowledge and labour comprised in Mr. Wyatt's paper, which he hoped would be produced before the members in a form which would enable them to study it; and that, by attention to the principles it conveyed, and the application of them to their own profession, architects might be induced to get rid of the white and grey surfaces which at present prevailed both in the interior and exterior of buildings, and which might be enlivened by the proper application of colour, with a small amount of labour and expense.

The vote of thanks was carried by acclamation, and the meeting adjourned.

WEIGHTS OF BUILDING STONES IN MOST GENERAL USE.

By C. H. Smith, Hon. Member.

The following table has been prepared by Mr. C. H. Smith for a Government publication, "The Mineral Statistics of the United Kingdom of Great Britain and Ireland," (part 2 to be published in this year), edited by Robert Hunt, Esq., F.R.S. Some of the statements have been printed in an early volume of the Transactions of the Institute, but the matter generally is new, and the Council consider that the paper is sufficiently interesting as to justify its being printed in the Transactions, although its tabular form prevented its being read at one of the ordinary meetings as usual.

The various stones were fair average samples from the respective quarries. In nearly all cases the weights have been determined by two very accurately squared six-inch cubes (duplicates) weighed in the state in which the stones are usually employed for masonry; having been merely squared and placed under an open shed, secured from rain, but fully exposed to the atmosphere during several weeks. The density of stones can be correctly ascertained, for practical purposes only, by some such method as this; for, in the usual mode of taking the specific gravity of such porous bodies in water, the results depend much upon their powers of absorption, which, in the case of building stones, are extremely various; some specimens absorbing only a very small quantity of water and other fluid, whereas certain beds of Caen stone will hold in a cubic foot rather more than 16 lbs. of water, or above six quarts. A stone may be very porous and absorbent, and yet durable; its durability depending upon the cementing substance, which holds the grains together, being strong enough to resist the chemical and mechanical actions of wind, rain, sunshine, frost, &c. Not that absorption is a desirable quality. A stone may be comparatively like a sponge, and yet last for ages without any material decay; but if several kinds of stone be equal in every other respect, that which soaks up least water will certainly be most durable.

In many engineering works the weight of the stone is of the utmost importance, especially for low buildings occasionally under water where there is a rapid current, or where they are subject to the influence of powerful waves; such circumstances will require a heavy stone to be used, because all bodies immerged are reduced in weight by so much as is equal to that of the bulk of water which they displace. The lightest stone that I have ever found in masses, fit for building purposes, weighs only about 103 pounds to the cubic foot. Now if such stone were used in sea water, it would be reduced by about 66 pounds, the weight of a cubic foot of sea water, and therefore it would be like building on land, with a material weighing 37 pounds to the foot, or about the weight of the lightest varieties of dry timber. The heaviest building stones that have yet come under my notice are the dark grey varieties of sand stone, from the vicinity of Swansea, Glamorganshire, Abercarne, Monmouthshire, the Forest of Dean, Gloucestershire, and the neighbourhood of Dundee, some of which are even heavier than granite, weighing upwards of 170 pounds per cubic foot. There is also remarkably heavy stone in some of the western islands of Scotland, particularly in the island of Tiree, composed of carbonate of lime, with a large quantity of hornblende in small nodules. Such stones are particularly well adapted for docks, harbours, breakwaters, sea embankments, and all other purposes where the violent commotion of water is to be contended against. In situations constantly or alternately under sea water, sandstone is preferable to limestone, because it is not so liable to be

perforated by the Saxicava rugosa, the Pholas, or other boring mollusca, which frequently honeycomb calcareous stones to the depth of several inches, thus changing a smooth plain face to an extremely rough one, and increasing the risk of the stones being disturbed by the action of waves, which are more powerful against an irregular surface than a smooth one.

The stone which possesses the least cohesive strength, or that which will crush with less pressure than any other, is nevertheless strong enough, when once fixed in a building, for almost all practical purposes. No architectural members have to sustain greater pressure, in proportion to their size, than mullions of large Gothic windows: the tracery in the great north window of Westminster Hall is now executed in Bath stone, which is remarkable for having the least cohesive strength of all the specimens described as experimented upon in the report on the stone for the new houses of Parliament; some of the mullions of that window are less than nine inches wide, and more than forty feet high, sustaining not only their own weight, but also that of the whole of the tracery beneath the arch. The eastern window of Carlisle Cathedral, built with a friable red sandstone, is fifty feet high; the mullions are smaller, and the tracery much heavier than in that at Westminster; yet in neither of these examples are there any symptoms of crushing. The cohesive strength of stones is never more severely tested than during their conversion by workmen from the rough state to being fixed in their final situation in a building. During these operations iron levers, jacks, lewises, and various other implements are applied, frequently with but little regard for the mechanical violence which a stone will safely bear; and it may, therefore, be considered a useful practical rule, that, however soft a stone may be, if it resist the liability of damage until out of the mason's hands, there can be little doubt of its possessing sufficient cohesive strength for any kind of architectural work. If the foundation be insufficient, or any part of the edifice give way, so as to cause an unfair or unequal pressure, a soft stone will, of course, yield sooner than a hard one.

Name of Quarry.	Nearest Post Town.	County.	Avoirdupois Weight per Cubic Foot.		
			lbs.	oz.	dr.
Gatton	Reigate	Surrey	103	1	4
Tisbury	Tisbury	Wiltshire	111	2	4
Coombe Down Lodge	Bath	Somersetshire	116	0	0
Totternhoe	Dunstable	Bedfordshire	116	8	0
Calverley	Tunbridge Wells ...	Kent	118	1	0
Windrush, soft	Burford	Oxfordshire	118	2	12
Farleigh Down	Bath	Somersetshire	122	10	12
Box Hill	Chippenham	Wiltshire	123	0	0
Park Quarry	Tixall	Staffordshire	124	9	1
Park Quarry	Corby	Lincolnshire	125	11	0
Dundry Hill	Bristol	Somersetshire	126	2	2
Cadeby	Doncaster	Yorkshire	126	9	8
Aislaby	Whitby	Yorkshire	126	11	0
Roach (Gorlings) Portland ...	Weymouth	Dorsetshire	126	13	13
Steetley (White)	Worksop	Nottinghamshire ...	128	3	0
Ketton	Ketton	Rutlandshire	128	5	12
Crawbank	Borrowstoness	Linlithgowshire ...	129	2	1
Old Down (Doulting)	Shepton Mallet ...	Somersetshire	130	4	0
Morley Moor	Derby	Derbyshire	130	8	9
Steetley (Yellow)	Worksop	Nottinghamshire ...	130	9	5
Heddon	Newcastle-on-Tyne ...	Northumberland ...	130	11	12
Longannet	Kincardine	Perthshire	131	11	11
Beer	Axminster	Devonshire	131	12	0
Dunmore Stable	Falkirk	Stirlingshire	132	2	5
Bottom Bed (Goslings) Portland	Weymouth	Dorsetshire	132	5	7
Duffield Bank	Derby	Derbyshire	132	14	12
Hollington	Uttoxeter	Staffordshire	133	1	4

Name of Quarry.	Nearest Post Town.	County.	Avoirdupois Weight per Cubic Foot.		
			lbs.	oz.	dr.
Castle's Quarry, Portland ...	Weymouth	Dorsetshire	133	6	7
Haydor	Sleaford...	Lincolnshire	133	7	12
Moakery	Corby	Lincolnshire	133	8	0
Brodsworth	Doncaster	Yorkshire	133	10	8
Pensher	Houghton-le-spring ...	Durham...	134	5	11
Vern Street, Portland	Weymouth	Dorsetshire	134	10	1
Way Croft, Portland	Weymouth	Dorsetshire	135	8	13
Humbie, Dark	Edinburgh		135	13	0
Gatherley Moor	Richmond	Yorkshire	135	13	9
Windrush, Hard	Burford	Oxfordshire	135	15	0
Hunger Hill	Belper	Derbyshire	135	15	4
Taynton	Burford	Oxfordshire	135	15	8
Sutton	Bridgend	Glamorganshire ...	136	0	0
Barnack	Stamford	Lincolnshire	136	12	5
Park Nook	Doncaster	Yorkshire	137	3	0
Duke of Hamilton's		Linlithgowshire ...	137	4	4
Hildenley	Malton	Yorkshire	137	10	7
Huddlestone	Sherburne	Yorkshire	137	13	8
Hawksworth Wood	Leeds	Yorkshire	137	14	12
Duke of Hamilton's		Linlithgowshire ...	138	2	0
Roche Abbey	Bawtry	Yorkshire	139	2	5
Ancaster	Sleaford...	Lincolnshire	139	4	13
Redgate	Wolsingham	Durham...	139	9	9
Meanwood	Leeds	Yorkshire	139	14	0
Scullcap, Portland	Weymouth	Dorsetshire	140	1	0
Humbie, Light	Edinburgh		140	3	8
Stanley	Bewdley	Shropshire	141	7	0
Catcraig	Borrowstoness	Linlithgowshire ...	141	11	0
Wass, soft	Thirsk	Yorkshire	141	11	1
Craigleith, bed rock	Edinburgh	Edinburghshire ...	141	12	0
Ham Hill	Yeovil	Somersetshire	141	12	1
Bramley Fall	Leeds	Yorkshire	142	3	8
Stainton	Barnard Castle	Durham...	142	8	5
Hookstone	Harrowgate	Yorkshire	142	10	0
Weetwood	Leeds	Yorkshire	143	0	0
Giffneuk	Glasgow	Lanarkshire	143	14	13
Anston, Norfall Quarry... ...	South Anston	Yorkshire	144	0	9
Anston, Stone-ends Quarry ...	South Anston	Yorkshire	144	3	8
Duke's Quarries	Cromford	Derbyshire	144	8	5
Kenton	Newcastle-on-Tyne ...	Northumberland ...	145	1	0
Victoria	Leeds	Yorkshire	145	3	8
Curf, Groove Quarry, Portland	Weymouth	Dorsetshire	145	9	9
Woodhouse	Mansfield	Nottinghamshire ...	145	12	4
Craigleith, liver rock	Edinburgh	Edinburghshire ...	145	14	5
Gun Barrel	Bewdley	Shropshire	146	0	0
Mansfield, White	Mansfield	Nottinghamshire ...	146	9	0
Corby	Corby	Lincolnshire	146	11	8
Barbadoes	Chepstow	Monmouthshire ...	146	12	5
New Leeds	Leeds	Yorkshire	147	8	0
Grove, Portland	Weymouth	Dorsetshire	147	10	11
Darley Dale	Bakewell	Derbyshire	148	3	3
Warwick	Huddersfield	Yorkshire	148	10	8
Mansfield, Red	Mansfield	Nottinghamshire ...	148	10	9
Amygdaloid	Crediton	Devonshire	149	9	5
Talacre	Holywell	Flintshire	150	4	4
Seacombe	Purbeck	Dorsetshire	151	0	4
Park Spring	Leeds	Yorkshire	151	1	12
Chilmark, Trough Bed	Salisbury	Wiltshire	151	6	12
Hoyle House, Clough	Huddersfield	Yorkshire	151	7	1
Chilmark, Penney Bed	Salisbury	Wiltshire	151	9	5

Name of Quarry.	Nearest Post Town.	County.	Avoirdupois Weight per Cubic Foot.		
			lbs.	oz.	dr.
Bolsover Moor	Chesterfield	Derbyshire	151	11	0
Elland Edge	Halifax	Yorkshire	153	4	9
Longwood Edge	Huddersfield	Yorkshire	153	7	0
Crossland Hill	Huddersfield	Yorkshire	155	4	1
Ketton, Rag Bed	Ketton	Rutlandshire	155	10	13
Viney Hill	Colford	Gloucestershire	155	11	12
Chilmark, Hard White Bed	Salisbury	Wiltshire	157	6	0
Scotgate Head	Huddersfield	Yorkshire	158	0	0
Hopton Wood	Wirksworth	Derbyshire	158	7	4
Lochee	Dundee	Forfarshire	158	11	0
Auchray	Dundee	Forfarshire	158	14	5
Lioch	Dundee	Forfarshire	159	3	1
Knockley	Colford	Gloucestershire	159	5	4
Mylnefield	Dundee	Perthshire	160	0	13
Munlochy	Munlochy	Ross-shire	160	9	11
Glammiss	Forfar	Forfarshire	161	2	8
Wass, Hard Bed	Thirsk	Yorkshire	162	8	0
Pyotdykes	Dundee	Forfarshire	162	8	13
Granite, Stirling Hill	Stirling	Stirlingshire	165	14	5
Granite, High Rock, Breadalbane			166	0	9
Dylais	Swansea	Glamorganshire	166	3	12
Kentish Rag	Maidstone	Kent	166	9	9
Black Hill, Granite	Stirling	Stirlingshire	166	10	4
Abercarne	Newport	Monmouthshire	167	15	5
Trebaunws	Swansea	Glamorganshire	168	1	9
Red Jacket	Swansea	Glamorganshire	168	2	8
Granite, Dalkey	Dublin		169	9	7
Granite, Bars, Breadalbane			169	11	5
Cenfas	Swansea	Glamorganshire	170	2	4
Mumble	Swansea	Glamorganshire	170	7	0
Black Marble	Kilkenny	Ireland	171	6	0
Tiree Marble	Hebrides	Scotland	172	5	0

Name of Bed or Quarry.	Nearest Post Town.		Avoirdupois Weight per Cubic Foot.		
			lbs.	oz.	dr.
Franc Banc	Caen	Normandy	116	2	0
Banc de 4 Pieds	Caen	Normandy	118	0	8
Gros Banc	Caen	Normandy	122	0	8
Pierre Franche	Caen	Normandy	123	3	0
Pierre de 30 Pouces	Caen	Normandy	128	5	0
Ranville	Caen	Normandy	142	6	0
Aubigny	Falaise	Normandy	150	6	8
Carrara, Statuary Marble		Tuscany	168	10	5
Carrara, Ravaccione Marble		Tuscany	169	2	8

APPENDIX.

DISCUSSION upon Mr. G. G. Scott's Paper, "Gleanings from Westminster Abbey," read December 5th and 19th, 1859.

Mr. Godwin, V.P., said, that in the elaborate, and admirable account which Mr. Scott had given them of Westminster Abbey, there was one point which they should not pass by without an expression of their opinion, which might have the effect of strengthening Mr. Scott's hands in respect to the restoration of the Chapter House. No one who had seen the exquisite casts of its ornamentation exhibited by Mr. Scott, or who had seen the sketch of its present condition, filled with wooden presses, and with its magnificent pavement hidden, could help expressing a desire that speedy means should be taken to restore this most beautiful work to its original state, as shown in one of the admirable drawings before the meeting. Such an act of restoration would tend to advance that school of decorative artists which was now so happily rising up around them. He thought indeed there ought to be some official vote on the part of the Institute, calling upon the Government to aid the authorities of the Abbey in restoring this Chapter House.

The Chairman concurred in the suggestion of Mr. Godwin as to the importance of restoring the Chapter House.

Mr. Scott called attention to the view of the Chapter House in its present state, and which gave a most excellent idea of its condition. He also pointed out a peculiar style of minute decoration on the Coronation Chair. In reply to an inquiry by Mr. H. H. Burnell, he stated that, for indurating the stone work of the dilapidated monuments, he had employed shell lac in a solution of spirits of wine. This was only fitted for interior works, and therefore was seldom required; but it had been found admirably suited to its purpose at Westminster Abbey.

Mr. C. H. Smith, Hon. Member, observed, that there was perhaps no other building in this country in which such a multiplicity of materials had been employed as in Westminster Abbey. The oldest part, built by Henry III, was, he believed, entirely of green sand stone, from Godstone in Surrey, a place which derived its name [God's stone] from the quantity of the stone taken for this religious edifice. The Jerusalem Chamber, and the early portions of the cloister, were of this material, which was in fact hearth stone. Purbeck marble was also employed to perhaps a larger extent than in any other building, and in the cloisters a magnesian limestone had been used very much like that of the New Houses of Parliament. Sir Christopher Wren found the green sand stone, of which a great part of the interior and exterior was composed, had decayed to a depth of four inches from the original surface, and this he restored with stone brought down the river from the Windrush Quarries at a place near Burford, Oxon.

This material was used in the North Transept doorway, the doorway to Henry VIIth's Chapel, and that to Poet's Corner. At a later period Mr. Wyatt, or rather the Abbey Mason as he was called, Mr. Gayfere, restored Henry VIIth's Chapel with Coombe Down, or Bath stone. Besides these materials Caen stone and chalk had been employed, so that this variety added to the interest of the building.

Mr. Scott said, that the several kinds of stone were mentioned in the old accounts, including Caen stone, stone from Reigate (being the Godstone Quarries), Corfe marble, stone from Bere in Dorsetshire, from Stapleton,—this being a magnesian limestone,—and several others. A "north stone" was also often mentioned, probably the same as the Stapleton limestone. The authorities appeared to have worked the quarries themselves, and to have sent the stone to a garden which they had bought at Battersea. Delay in the works was in some instances accounted for by the

quarries being worked out, and then there was a payment to a man for finding a new quarry. The accounts were in Latin, though many English words were used in a slightly altered form. He had found perhaps the earliest use of the word "wainscoat" as applied to oak, in one of the accounts of the time of Richard II.

Mr. Scoles, Fellow, inquired if the paintings on the antependium, described and illustrated by Mr. Scott, were executed in oil.

Mr. Scott said that Sir Charles Eastlake had failed to discover the medium. He himself thought they were in oil, or rather that these, and all other paintings of the period in England and other countries, might properly be called varnish paintings, the artists having mixed a resin with the oil. Mr. Stothard had had some of the paint from the tomb of Aymer de Valence analysed, and it was proved to have been employed in a resinous medium. With regard to the wall paintings, the question was a difficult one, as oil painting on a damp wall would soon resemble distemper; but those which were best preserved looked like oil paintings. In the accounts of St. Stephen's Chapel there were numerous entries of purchases of oil and varnish for the paintings, the varnish being purchased by weight and the oil by measure; and Sir Charles Eastlake thought the varnish was used to thicken the medium, and to use it as a varnish outside.

Mr. T. H. Lewis, Hon. Sec., inquired whether there had been found anything to show who had been the actual designer or architect of any part of the Abbey.

Mr. Scott thought that nothing of the kind had been discovered.

Mr. Burtt, Visitor, said, there was no entry or allusion to any architectural designer whatever. The accounts consisted almost entirely of minute references to so many feet of moulding, to the materials and labour supplied, and persons and places supplying them, or to some means of working the architectural details. As far as regarded design or plan, there was no reference whatever.

Mr. Scott observed, that in the last of the papers he had received from Mr. Burtt he had observed a change in the name of the master mason, in the time of Henry III. The name of Beverly appeared in that capacity.

Mr. Burtt said, there were several changes in the name of the master mason, but the whole of Henry III.'s work seemed to have been done under the superintendence of Adam de Stratton, who was a great and well-known man of that time, and who in the subsequent reign as a baron of the Exchequer, incurred a severe fine for some peculations in his office. This Adam de Stratton had the entire supervision of the works at the Abbey, and the "magister cementarius," who superintended them under him, seemed to have been changed every two or three years. As far as their names gave any reason to judge, they appeared to have been decidedly Englishmen.*

Mr. Ferrey, Fellow, asked Mr. Scott if he had met with any old drawings or tracings tending to show how the ancient architects or masons set out their work. He (Mr. Ferrey) had been lately engaged on some works at Christ Church, Hampshire, and he had there found a room, closed in with shutters, which was said to have belonged to the "Castellan" of the church, which was an office he could not

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* Since these remarks were made, Mr. Burtt has found an entry in a calendar of the early part of the 14th century, which shows, as might be expected, that the rolls of which notices have been given, were but a small portion of the early accounts relating to the Abbey. When Walter de Stapleton, Bishop of Exeter and Lord Treasurer of Edward II. re-arranged the contents of the Royal Treasury, the calendar made by his directions says, that there were then deposited in the Treasury four pouches or small bags of canvass, "continentes rotulos et tallias de debitas stipendiorum cum diversis emptionibus factis pro ecclesia et curia Westm. tempore regis Henrici prout patet in antiquis billis eisdem puchiis annexis." It was the practice to indicate the contents of boxes and bags in the Treasury by some outward sign, and these pouches were all marked with the figure of a church.

understand. Others stated that it had been a muniment room; but he believed it had been used by the master mason when carrying on the works. In this room, on taking down the shutters, he had found upon some ancient plaster, a complete incised outline of a beautiful geometrical window, with all its centres marked, and everything as complete as if it had been done in an architect's office of the present day. This in itself was very curious, but in comparing this outline with an opening which had been left in one of the windows of the south aisle of the nave, he discovered that the design corresponded entirely with the opening, so exactly that the mason was at the present time making a new window from this original mediæval design. He had never heard or met with any similar instance, but he thought it possible that Mr. Scott might have met with something of the kind at Westminster Abbey.

Mr. Scott said that he had not been so fortunate. If anything of that nature were in existence it must be in the room shown in one of the drawings, over the northern portion of the east cloister, which contained, as he had stated, a number of immense ancient chests, the contents of which were unknown to any one now living. He had often wondered whether the box (12 ft. 6 in length), of which he exhibited a drawing, might not contain some original working drawings; and it would be very desirable if it could be pressed upon the Dean and Chapter to have these old chests ransacked The instance mentioned by Mr. Ferrey was very remarkable and interesting.

Mr. Ferrey wished to inquire if Mr. Scott had met with any other building so closely resembling Westminster Abbey as to lead to any inference as to the identity of the architect. The church at Crondal, near Farnham, had undergone considerable restoration, and he (Mr. Ferrey) had been forcibly struck with the complete identity of all its details and mouldings with those of St. Cross, at Winchester. The church at Crondal was originally attached to the Abbey of St. Cross, and there was no doubt that Henry of Blois was the founder of both. The mouldings and all the ornamental details appeared in each case to have been worked from the same mould.

Mr. Scott observed that he had not met with any church so closely resembling Westminster Abbey as in the case cited by Mr. Ferrey; but it was clear that the architect of the north transept of Hereford Cathedral must have seen the former structure, though the merit of his work was not equal to that of its prototype.

Mr. Scott briefly remarked on the scarcity of original working drawings of mediæval buildings in this country, whereas there were many preserved in Germany and Belgium; and referred to the Cathedral of Amiens, where the vaulting had been set out on the pavement, with the sections of the mouldings of the full size.

Mr. Donaldson, Fellow, mentioned a similar tracing in the church of St. Paul Without the Walls at Rome, which appeared to represent the original design of Bramante for the cupola of St. Peter's. This was traced upon the marble of the wall; but he believed it had been destroyed when the church was burnt.

Mr. C. H. Smith said that only a few years ago he had seen workmen engaged in the Cathedral at Rouen, in making a full-sized drawing on the floor of the church, and scoring in the lines with the chisel.

The vote of thanks was carried by acclamation.

After Mr. Burnell's Lecture, January 9th, 1860, James Edmeston, Fellow, read a Paper

ON THE USE OF ZINC IN ROOFS, AND THE CAUSES OF FAILURE THEREIN.

[A copy of this paper, illustrated, has been presented by Mr. Edmeston to each member.]

Mr. Ashpitel, Fellow, said that he believed zinc had been employed for the roofing of a very large number of the new public and private buildings of Paris, including the whole of the new Palace of the Louvre, the buildings of the Rue de Rivoli, and the Boulevart de Sebastopol.

Mr. Edmeston, Fellow, observed that the use of zinc for roofing purposes in Paris was almost universal, its extremely low price having led to its superseding nearly every other material.

Mr. G. R. Burnell, C.E., Visitor, said that for twelve or fourteen years zinc had been the favorite material for roofing in France, and he could understand why it would answer there, though not in England. Differing with Mr. Edmeston, he believed that the sea air had an injurious effect on zinc roofs, and had been the cause of their failure at Havre and elsewhere. As applied to the sheathing of vessels, he considered that a more dangerous material than zinc could hardly be used. This was well known to every ship-builder, and zinc was employed only by those who sought to turn out cheap ships. It was most desirable that further inquiries should be made before it was adopted to any great extent. The most important question was as to the purity of the metal, upon which its practical utility entirely depended. The smelting of zinc was a far more difficult operation than the fusion of iron or lead ore, and he had himself found a great variety and irregularity in the quality of this material. The ores of lead and zinc were almost always obtained together, and, during the last autumn, he had occasion to survey a mine in which lodes of lead and zinc crossed each other; care was therefore required to produce either metal in a state of purity. In London, zinc would be more exposed to the effects of rain water, carbonic acid, and ammonia, than in Paris or Munich. Another point to be considered was the chemical action which took place when zinc was in contact with chesnut or oak timber. As to chesnut, he believed the employment of it to be a myth; but when oak was placed in contact with zinc, any carbonic acid in the water would lead to a decomposition of the metal. One of the great difficulties of zinc-roofing in London would arise from having box gutters, or trough gutters, instead of dripping eaves, because where it became necessary to have an angle, there would be a cracking of the zinc along the edge; and, wherever solder was employed, the presence of water would lead to decomposition. He had seen many cases of this kind both in England and abroad, and the result was in his mind unfavourable to the employment of zinc for roofing.

Mr. Morris, Associate, called attention to the Corn Exchange, in Mark Lane, constructed from his design about twenty-eight years ago. The peristyle at that time surrounded an open area, and the corn factors desired to be more protected from the weather. He accordingly suggested a design, consisting of iron beams supporting a dome,—made of carpentry, with gutters of lead,—and, as it was necessary that the dome should be as light as possible, he employed a covering of zinc, of 18 ounces to the foot, and he believed that it had stood, without any reparation whatever, to the present time.

Mr. I'Anson, Fellow, said that the manager of the Vielle Montagne Company had declared to him that zinc had always failed in England through parsimony in the use of it; and that it ought to

be always twenty-one ounce zinc. Zinc would oxydise rapidly, but, unlike the oxydation of lead, it was permanent; and when a thin sheet of zinc was employed it was soon eaten through and destroyed, but with twenty-one ounce zinc the permanent oxydation served to protect the metal. He had himself used zinc for flats and gutters, where it had stood perfectly well for twenty years; he had also employed the stamped zinc for ornamental purposes, but the pattern books were not to be depended upon, as the articles sent over were often very different to the patterns.

Mr. Edmeston said that lead did not act injuriously in contact with zinc. At the Palais de Justice, at Paris, it had been laid in the year 1821, and was as sound now as when it was first fixed. He noticed the difference in quality in zinc smelted from blende, and that smelted from calamine. With regard to the application of zinc for ship sheathing, he only knew that it was said to last as long as copper, and that the barnacles adhered to it because the oxide was immoveable. The cracking of zinc at the bends of the gutters might be obviated by the use of zinc in a state of purity.

Mr. Jennings, Fellow, observed that the discussion had been almost entirely confined to zinc, but the quality of all kinds of building materials was of equal importance, and in timber especially it varied exceedingly. The Californian wood, exhibited in ornamental panels by Mr. Burnell, was only to be obtained in the market in such small quantities as to be hardly worth mentioning. He believed that uric acid had an injurious effect on zinc, as, while that metal was successfully employed for water pails, the attempt to use it for slop pails was a failure. If properly laid, he had no doubt zinc would succeed for roofs; and although he had seen the injury arising from its contact with solder, he had not found the effect of cracking at the angles if the work had been properly done. All zinc should bear the mark of the Company supplying it, a rule, indeed, which applied to all building materials.

Mr. C. Barry, Fellow, made an enquiry as to the expansion in zinc from the variation of temperature, as compared with that in lead or iron,—a question which would affect the point of its cracking, and its use generally in gutters and flats.

Mr. Edmeston said that the expansion in zinc was considerably greater than in lead. It was said to be more affected for the first three or four years than afterwards. The whole system of the foreign mode of laying zinc roofs consisted in giving it as much freedom as possible.

Mr. Ashpitel, Fellow, considered there was no reason why zinc, which stood so well in Liege, the Birmingham of the Continent, where there were thousands of chimneys vomiting smoke, should not stand equally well in London. The zinc was not smelted at once, but was made in crucibles, in which it was allowed to stand for some hours before it was taken out, and then there was a subsequent fusion of it. In considering chemical action upon zinc, the effect of galvanic action had been overlooked, although the latter was a matter of some consequence,—as might be seen from the decay of the wrought iron railings of some of the London squares, which, having been let into the stone with lead, were affected very seriously, and frequently to the extent of nine inches or a foot upwards. If zinc could be made available for practical purposes, with the amount of perfection shown by the zinc wire produced by Mr. Edmeston, gutters might easily be joined without solder; and if sufficient freedom were allowed in laying the zinc, the question of expansion and contraction was not a matter of much importance. He concurred in the opinion that the cracking of zinc gutters arose from the mode of laying rather than from any defect in the material itself. The extreme lightness of zinc, and of the timber framing required to carry it, were very favourable points, and its susceptibility of being put into artistic forms at a cheap rate, gave it a great advantage over lead.

The Chairman observed that he had known instances in which zinc roofing had failed; but he knew a case in which it had been employed by his father, thirty-two years ago, and where it had stood

well without any repair. Its success appeared to depend upon a number of small circumstances, and the difficulty was to get all these in the necessary perfection. Many important points in Mr. Burnell's paper had not been noticed in the discussion,—especially that of concrete, upon which, if time had permitted, he should have made some remarks himself.

Mr. Donaldson, V.P., thought that in questions of complexity with regard to building materials, Committees of the Institute should make experiments, and report upon them.

Thanks were unanimously voted to Mr. Burnell and Mr. Edmeston.

THE END.

PAPERS

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RECOLLECTIONS OF SICILY.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, November 5, 1860.

By Sydney Smirke, R.A.

There is, probably, no part of Europe which, within such narrow limits, offers to the traveller so many objects of archæological and artistic interest as Sicily, and yet hardly any part of Europe is so little visited by the architectural or antiquarian tourist. The cause of this neglect may, perhaps, be found in the fact that the island lies out of the ordinary track of tourists; it offers but few of the facilities for internal travelling found in most other countries of Europe, and, therefore, cannot be traversed without a good deal of personal inconvenience. The inns are, for the most part, wretchedly bad, and often altogether wanting; bridges are few in number, and roads often mere mule-tracks. Sometimes indeed, the only road, if road it may be called, is the dry bed of a mountain stream.

Whatever may have been the causes, certain it is that Sicily has been very imperfectly explored by artists and archæologists, although it is a land abundantly rich in the remains of every age of historical interest, Phœnician, Greek, Roman, Arabian, Norman, and Mediæval.

I will not dwell on the strong claims this island has on the attention of the naturalist. It is *here*, only, in Europe that we find growing wild the papyrus and the palm, productions which seem to link it with the East, and aid the remains of Saracenic art in recalling to our memories the age of the Califs, whilst there are not wanting traces of architecture which forcibly remind us of the times of our first Henrys and Richards. So multifarious, indeed, is the interest with which this sequestered island is invested that I cannot but be surprised at the slender amount of knowledge usually possessed by even the best informed artists and antiquaries on the subject of Sicily. I feel, therefore, that I shall be excused if I venture to occupy your attention whilst I bring before you a condensed record of my recollections of a professional tour made in that country by me upwards of thirty years ago.

In most countries of Europe observations made from notes of so old a date would be of little value, or perhaps wholly inapplicable to the present day; but I need entertain no such apprehension in *this* case. Until the memorable events of the last few months, Sicily has long been, as it were, a land of the dead for the purposes of the traveller or the student; neither its moral, political, nor physical improvement has been attempted under its later dynasties; but both the place and its population have remained stagnant, neglected, and asleep. Let me refer, for example, to that silent wilderness of antiquities which extends for miles over the site of the ancient Selinus, where some thirty or forty years ago two young English artists, Mr. Harris and Mr. Angell, turned up a few stones and found on them fine specimens of archaic Greek sculpture. These awakened the attention of the sleeping antiquaries who seemed never to have dreamt that such treasures existed beneath the dense mantle of cactus and myrtle trees that lay over the prostrate temples. Yet when I visited those ruins a few years afterwards their discovery appeared to have led to but trifling farther researches; the upturned metopes were deposited, it is true, in the nearest museum, but were still gazed at with barren astonishment; they were *talked* about abundantly by that loquacious and inactive people, but the interesting discovery excited few efforts to explore the mine which the stranger had opened, and the listless antiquaries were again folding their arms and composing themselves for another cycle of sleep.

There were no doubt a few individuals more enlightened than their fellows, who wrote their "*Saggie*," or "*Trattati*," but like earthworms they laboured sedulously only on the spot where they chanced to be born, and with little consciousness of what was going on around them in the outer world. Some idea may be formed of the contracted vision and tepid zeal of these local savans from the fact communicated to me on the spot, that a very eminent antiquary of Catania, who had written and published much on archæological subjects, had never been at Syracuse ; and that Pisani, a local savant who wrote a work on the sculptures discovered by Harris and Angell, had never visited the spot where they had been discovered. I would by no means include in this category such authors as Hittorf, and Serradifalco, and our own writer, Gally Knight, whose finely illustrated works are noble contributions to our art, and are able expositions of the known remains ; but even they have done little towards increasing the stores of antiquarian knowledge. The great cities of antiquity in Sicily owe their ruin not so much to gradual decay as to external violence, such as sieges, earthquakes, and volcanic eruptions. Sudden and general convulsions of this nature, overwhelming a whole city, may be expected to have caused the interment of much that is valuable to the artist and the antiquary without destroying it. Such proved to have been the case at Selinus, as I have just stated, and it cannot be doubted that much remains throughout Sicily to reward the labours of a diligent explorer. I will now request you to accompany me whilst I cursorily review some of the objects of professional interest that presented themselves to me.

My course commenced at the beautiful port and city of Messina, many of whose handsome buildings I found still bearing marks of the ravages of repeated earthquakes. There is, however, not much here to attract the attention or invite the study of the architectural student. The cathedral is not without considerable interest ; presenting, as it does, specimens of almost every successive style from Byzantine to cinque cento ; whilst the pillars of the nave consist of shafts derived from the ruins of some far more ancient temple, affording an example of the practice once so prevalent throughout Italy, of the adaptation of classical relics to Christian purposes. This practice, prevalent among the builders of the early churches, is analogous to that, also prevalent in the early ages of Christianity, of attempting to reconcile Pagan doctrines and rites to the principles of Christian theology, for the purpose, it should seem, of making the work of conversion more easy for the missionary and more acceptable to the convert. Whether this was justifiable is open to doubt, but certainly it was carrying the doctrine of expediency very far when churches were dedicated to St. Mercurio and St. Venera. In various parts of the city are examples of late Gothic somewhat purer, or at least somewhat more nearly allied to our own northern Gothic, than is usually met with on the adjacent continent of Italy. I am but little acquainted with Spanish Gothic, but I suspect that the later Gothic of Sicily will be found to resemble it in many respects. There is here an octagon tower much shattered by earthquakes, and but little of it left to identify its age, which is traditionally reported to have been erected by our first Richard, and which to this day bears his name. A small early Norman church which I observed at the southern extremity of the city, called La Nunziatella, is remarkable for having on its door jambs, inlaid in coloured marble or porphyry, part of an Arabic inscription in honor of Messala, a Saracen chief. These jambs, had no doubt, formed part of some previously existing building which the moslem masons employed by their Norman conquerors were glad of the opportunity of reinstating. It struck me at once as much resembling the ornament designated by Dr. King, in "Munimenta Antiqua," the "*scribbled ornament*," which may possibly be an Eastern tradition, testifying to the Oriental origin of some of the features of the Mediæval architecture of Europe. I purpose in these notes to confine myself almost exclusively to professional subjects, but I may say, in passing, that near Messina I observed a treadmill very

similar to the machine which with us has obtained so unenviable a notoriety, but which here was worked in the open air by six, no doubt perfectly honest, women for the purposes of pressing calico.

The next place I visited was Taormina, after passing the Gothic fort of St. Alessis, which had been repaired by English engineers during the late war; passing also Da Forza, a small town which although built high up on the side of a mountain, was described as grievously liable to be afflicted with malaria, and affording an instance of the apparently capricious, but subtle and inscrutable, character of that insidious scourge. Taormina is placed on a most commanding eminence, and is said to have been the last city in Sicily to yield to the Arabian invaders. Here are very interesting remains of an Hypæthral theatre, a Naumachia, and a reservoir for water, resembling the "Piscina mirabilis" on the Neapolitan coast; its groined vaulting rests on piers of brickwork coated over with cement $2\frac{1}{2}$ in. thick: there are also many tombs of classical character. Among the ruins of the theatre I observed examples of the practice of the Roman masons of lining the surface of stone with extremely thin slabs, I might almost call them *films*, of coloured marble. It is open to much question whether this comes under the denunciation of *shams* in architecture. The block of common limestone, so lined, presents the appearance of a marble, which it is not, and is therefore so far deceptive; yet a charge of fraud seems scarcely tenable, seeing that the material used is really what it seems to be, although the quantity of the precious substance falls far short of its apparent bulk. I cannot leave Taormina without remarking how these vast ruins testify to the vicissitudes to which the island has been subjected. Numerous, indeed, must have been the population of this city, and great its prosperity, when one of its places of amusement was capable of receiving 30,000 spectators. A few straggling dreary streets exist to mark the site of this great centre of ancient civilization.

My next resting place was Catania, a city which owes its modern and regular appearance to the frightful eruption and earthquake of 1693, which destroyed the old city and devastated the surrounding country, covering extensive districts with volcanic scoria, which remain piled up in amorphous masses, dark and arid, relieved by few indications of vegetation, except where the cactus has found a hold for its roots in hollows of this wide waste of cinders. Beneath the surface on which the city is built lies another bed of volcanic ashes, and within this bed lie the remains of various fine Roman buildings, including a noble amphitheatre, itself built of blocks of lava, and vaulted with pumice stone, the products of still remoter eruptions, so persistent has been the activity of these Ætnean fires. The application of volcanic scoria or pumice in the vaulting of the corridors of this amphitheatre, bears witness to the constructive ability of the Roman builders; the springings and main ribs are executed in sound brickwork, whilst the interstices, spandrils, and other parts of the vaulting are wholly executed with this light, yet hard, material in its rough state, but run in solidly with Pozzolana cement. That this mode of construction is substantial is evident from the permanence of the work in these ancient corridors. The dome of the Pantheon at Rome is executed in the same manner, and has stood the sieges, earthquakes, and all other causes of damage and decay for nearly 2000 years, and I think it worthy of enquiry whether a safe, permanent, perhaps even economical vaulting might not be similarly executed with *coke*, a material which has many of the properties of a volcanic scoria; is extremely light, and yet so hard as to be able, like the diamond, to scratch glass. Notwithstanding the labour of Prince Biscari, much remains unexplored in this Amphitheatre, and still more of the adjoining Odeon, which was also entombed, like Herculaneum, beneath the fiery shower. Far below the present surface, and beneath the modern Duomo, lie the remnants of a magnificent building used by the Romans as public baths. Glimpses of its ornamented halls are obtainable by descending to a considerable depth with ladders and torches into the excavated portions of the building. There are also various other Roman antiquities of less importance, but testifying to the wealth and population

of this now half deserted spot; evidence, too, of the deplorable want of energy and enterprise in the government and people, who can permit objects of so much interest and historical value to be unexplored under their very feet. A spacious and handsome Benedictine monastery is one of the most conspicuous modern buildings of Catania. It existed before the great convulsion of 1693, and its exemption from the calamity is attributed to the forbearance of the flood of lava, which, after having destroyed in its course all around it, miraculously stopped abruptly short just as it approached the sacred edifice. The Museum of Prince Biscari, here, is well known to European antiquaries; it is rich in fictile works and bronzes, and contains some good sculpture, including a Torso of the highest character of Greek art. There is in the town, also, a small collection of natural history. Another similar collection is at the University, and a third, of natural history and works of mechanical art, contained in four or five good sized rooms at the monastery to which I have just alluded. The road from Catania westward lies over a tract of country once so fertile as to have become the fabled cradle of agriculture, but now, through neglected drainage, little better than an unproductive waste. A few miles inland is the Beviere or Lago di Lentini, the drainage of which was one of the labours of Hercules, and one in which he certainly showed little engineering skill, for the lake is to this day a frightful source of malaria.

The next place of interest in my progress along the coast, was Syracuse, a city of highest historic interest, but presenting an extraordinary scene of decay and desolation. An inconsiderable sea-port *now*, it was, 2000 years ago, a great centre of luxury and civilization, the extent of which may be judged by the vast tract of country strewed with the fragments of buildings. The ride from one extremity of these heaps of ruins to the other occupies some hours, and almost every step passes over some remnant of fallen grandeur. I shall not stop to enumerate the various objects of interest here. The theatres, tombs, temples, latomie, have all been described by travellers, although by no means illustrated, or indeed examined, as carefully and thoroughly as they deserve; and there can be no doubt, that an earnest, intelligent, and systematic exploration of that which lies beneath this wild scene of decay, overthrow, and dilapidation, would be abundantly productive. The labour of riding and scrambling over these relics of antiquity, was, in my case, agreeably relieved by a boat excursion up the Cyane, a small stream having its source in a lake of inconsiderable size which produces the papyrus in great abundance; I was informed that this is the only habitat of that aquatic plant in Europe; at all events its occurrence is of extreme rarity there. It is indeed a graceful, and even noble reed-like plant, of which the commercial value and importance have yielded in modern estimation to the superior claims of old rags. In the ancient and entirely ruined part of the city, called Neapolis, are remnants of two towers named the Epipolæ, parts of the ancient fortifications which are traceable over a great extent. Shortly previous to my visit, several subterranean galleries had been discovered within these fortifications. The theory of the local antiquaries is, that they had been formed as sally-ports in case of a siege. The gallery I measured, was 9 feet wide, and is covered by a flat segmental arch; a fact of some interest if the workmanship could be satisfactorily proved to belong to the Greek period, which appearances, as well as the history of Syracuse, seem to favour.

In the more modern part of the city, called Ortygia, are some interesting remnants of Mediæval date, for the most part widely differing from the type of northern Europe. The Duomo itself is an epitome of the vicissitudes to which the city has been subjected. The side walls consist of a range of Greek Doric columns, portion, no doubt, of some temple, the intercolumnations being walled up with less ancient masonry. The principal front is a somewhat overloaded modern composition, whilst the ceiling within is undoubtedly Mediæval.

I visited the Museum, which was small, consisting exclusively of miscellaneous antiquities found

in the town and its neighbourhood. It contained a statue of Venus, life-size, found in the quarter of the ancient city called Acradina, near the entrance into the Catacombs. As the Port of Syracuse is more frequented by visitors, naval officers, and others, than probably any other ruined site in the Island, a large and active traffic is carried on here in antiquities of very doubtful genuineness. Considerable bags full of Syracusan coins were freely offered to me by dealers of questionable character; and there are local potters who have acquired a dangerous dexterity in the manufacture of terra cottas. I must not dwell on the Latomie, the ancient stone quarries here, though presenting scenes highly picturesque and interesting. Nor on the so-called Ear of Dionysius, about which so many fantastic, though by no means plausible, theories are propounded. Nor does my time admit of any description of the numerous tombs of undoubted classic age. Nor on the far famed fountain of Arethusa, whose poetical character is sadly at variance with its present degraded aspect; much of the dirty linen of the modern Syracusans seeming to be cleansed in its waters. I must, however, note, that somewhat removed from the city, is a small church dedicated to S. Marcian, which is reputed to be one of the earliest Christian buildings in Europe. The crypt of this church, containing the sarcophagus of the saint, wears certainly an aspect of extreme antiquity. A seat in it, which is regarded with great reverence as the first Episcopal throne in existence, consists of an ancient Roman Ionic capital somewhat ingeniously inverted so as to make the volutes form as it were the elbows of the seat. From Syracuse I was induced to deviate inland from the main road skirting the coast, by the accounts of certain remarkable excavations then in progress by the Baron Jutica, on his own estates near Palazzuolo, about 24 miles from Syracuse. After riding that distance, I had to pass the night at a Capuchin convent, for here a traveller who quits the main road soon finds himself without even the slender accommodation of a locanda. Less than a mile from Palazzuolo were the excavations that I sought for. The hill of Acramonte where they are situated, is the site of the ancient city of Acræ. The Baron considered from the evidence afforded by the remains which he had discovered, that on this spot originally stood a Phœnician city; that it had been successively inhabited by Greeks, Romans, Christians, and Saracens. There are here remains, only in part excavated, of a theatre, and an odeon; the former similar to that at Syracuse, but smaller; there is also a naumachia, an amphitheatre, a forum, various temples and numerous tombs.

These ruins lie like geological strata, successively superimposed on each other. The lowest excavations, about thirty feet below the general surface, present remains of what the Baron pronounced to be a kind of barracks, with a prison attached. There are fifteen rooms leading into each other, and in one of them is a shaft leading down into some deeper, and still unexplored, recesses. Several pits also have been discovered, into which various horizontal subterraneous passages lead from the outer surface of the hill. The purpose of these singular excavations is not obvious; the Baron's opinion seemed to be that they were intended as vents for dangerous vapours pent up within the earth in this volcanic district. There is, indeed, an extinct volcano at no great distance from this spot. Some remarkable bas-reliefs are cut on the face of the rock at or near the foot of this hill of Acramonte. These Santoni, as they are locally called, are of very Archaic and almost Persepolitan character; but my view was too hasty to admit of forming any opinion as to their precise age. Baron Jutica's museum was rich in bronzes and terra cottas; some bearing Phœnician characters, others of decidedly Greek workmanship, others again Roman. These articles are as various in their nature as may be supposed, seeing that they are derived from the reliquiæ of a great city. Many glass vessels were found of undisputed Phœnician workmanship; some of opaque glass, others coloured through their whole substance. Among many other curious objects was an

armlet of iron plated with silver. I proceeded afterwards to explore a remarkable necropolis at Ipsica, about five miles from Acramonte. It lies in a rocky valley, and consists of a multitude of caverns cut in the face of the rock, which being stratified in regular horizontal beds offers great facilities for such excavations. Many of these caverns are catacombs, lined with tombs, on some of which early Christian inscriptions in Greek characters are still traceable. There are, however, many caverns without any indications of interments having been made, and I found that the prevalent, not improbable, belief on the spot is that this valley presents the remains of a troglodyte city, occupied by the earliest, perhaps Celtic inhabitants of the island, and that it had been in after times applied to the purposes of sepulture. It is worthy of remark, as perhaps confirmatory of this opinion, that at Modica, a town scarcely a day's journey off, there are many separate habitations, and even streets, formed, exactly as these caves at Ipsica, by excavating the face of a cliff, or rather the escarpment of a stratified rock. I should, however, state, as regards Ipsica, that the decided opinion of the Baron, as expressed to me, was that the caves had been originally excavated by the early Christian population expressly for burial, and that it was, in fact, a great Christian necropolis. It seems to me not improbable that these rocks may have been excavated and dwelt in by the earliest occupants of the island, and that, long afterwards, the deserted caves may have been regarded as a fitting resting place for the bones of the earliest Christians. Nothing, indeed, can well be imagined more secluded and desolate than this rocky valley, well illustrating the difference of feeling on the subject of sepulture between the Christians and the Pagans, who were wont to parade their tombs along the highways and by the road side.

From Commossa to Terranuova the road lies over a richly cultivated but somewhat sandy and perfectly level plain, apparently redeemed from the sea; upheaved, perhaps, by subterranean forces, such as have undoubtedly operated, and possibly may still be operating, in this volcanic region. From thence by Palma I reached Girgenti, adjacent to the ruins of Agrigentum. I will not dwell in any detail on these highly interesting ruins, for they have had a fair share of the attention of the architectural and antiquarian world. Wilkins, Hittorf and Serradifalco have published illustrations of them; and I need not remind you that our own accomplished President gave great attention to them. The temples which are specially referred to in my own notes are those of Juno Lucina, of Hercules, of Concord, of Jupiter Olympius, of Æsculapius, of Proserpina, and of Castor and Pollux. At least such are the deities to whom these ruins have been assigned by the local antiquaries. Most of the buildings present but a confused mass of mutilated blocks and fragments piled together; this is especially the case at the temple of Hercules and that of Castor and Pollux; so confused a heap have they become that it is impossible to define their plan on a mere superficial inspection. Some of the blocks of stone thus piled together are of colossal dimensions. Even at the small temple of Proserpina I measured a block 8 ft. 6 in. by 3 ft. $10\frac{1}{2}$ in. by 2 ft. 10 in., weighing therefore five or six tons.

Indeed, there are, when viewing these stupendous ruins, few things that excite more surprise in the mind of the architect than the wonderful solidity of the mode of building practised by these Greeks. It is not flattering to contemplate the wide difference of practice in this respect between the builders of the sixth century *before*, and of the nineteenth century *after*, the Christian æra. It was a saying of Plato, as reported by Ælian,* that "the people of Agrigentum built as if they were to live for ever, and feasted as if they were always about to die." Ælian goes on to say, that "Timæus reports that they use oil flasks and strigils of silver, and had entire couches of ivory."

* Æliani Variæ Historia, lib. 12 sec. 29.

It should not, however, be overlooked that the contrast between the domestic architecture of the Greeks and that of our present generation, would probably have gone far to redress the balance, if the Greeks had left behind them any adequate means of comparison. The temples of Juno and Concord are the least mutilated, and in their ruin present most beautiful and picturesque objects. The temple of Jupiter is the most remarkable for its magnificent size, with the flutes of its columns 14 inches wide, and for the singular example it offers of the use of caryatides in interior temple architecture. These caryatides were built up in courses like columns, and are about 25 feet high and 6 feet across the hips. One was lying on its back, having been recently put together by Signor Politi. There had been then found portions of nine other similar statues. An idea of the huge proportions of this temple may be gathered from the fact that the diameter of the columns of the peristyle is not much less than two-thirds of that of the Monument on Fish Street Hill.

Little need be said of the modern town of Girgenti: it is built very irregularly, but is of some extent, and is not without some signs of a certain degree of prosperity. There is an extensive ecclesiastical seminario and a Cathedral. The latter is a modern structure, remarkable for a porta-voce, which it is usual to point out to the notice of strangers. Although the building is of great length, a low whisper at the west door is said to be distinctly audible behind the altar at the eastern end, and that notwithstanding the interception of a transept. I had, however, no opportunity of observing the phenomenon myself, on account of the sounds attending the performance of service at the period of both my visits to the building. I should add, that the nave consists of a Doric colonnade with a continuous unbroken entablature, a circumstance, no doubt, favourable to the conveyance of sound. The baptismal font is remarkable, being an ancient sarcophagus, of classic workmanship, applied to this very different purpose. The sides are sculptured with figures about three feet high, the subjects being taken from Phædra and Hyppolitus. Many doors, windows, and other details are met with in Girgenti of Norman architecture, in which the chevron ornament is profusely used, a peculiarity the more notable from the general absence of that ornament in Italy, contributing therefore to strengthen the presumption that the Norman adventurers brought their arts as well as their arms to this island. I cannot quit Girgenti without here bearing testimony to the kind courtesy of Sig. Politi, our worthy member, a highly cultivated antiquary and scholar, whose refinement was the more striking when found amidst a semi-barbarous and ignorant people. Nor can I refrain from jotting down the inscription which I observed painted on the exterior of his bookcase, bearing melancholy testimony to the irregular habits of some of his ungrateful visitors:—

" Perduto o multi libri col præstarli;
Contentati, Lettor, soldi mirarli;
Se dell' avviso à profittar se' inabile,
Un grand Minchione sei imminchionabile."

A ride of forty miles, over a level and richly cultivated country, brought me to Sciacca, a large rambling town, wearing an aspect of so much poverty as to excite one's regret that a country so richly endowed by nature should not be in the hands of a more active and industrious people.

The only architectural object here was a convent of nuns outside the eastern gate, which was a large and striking building of perfectly Mediæval character, and, as far as could be judged from the exterior, but little modernised. The impossibility of gaining admission of course greatly increased my desire to enter; a visit to the interior would doubtless have been, as it were, to step back at once into the Middle Ages. But my curiosity was not gratified. Twenty-four miles ride brought me to Castelvetrano, a town at no great distance from the ruins of Selinunte, now only a dreary waste of

mutilated masonry, It is even more entirely ruined than Agrigentum. It appears to have been built upon two low hills close to the sea side. Little of all this vast tract of ruin is now definable, except some of the external walls and portions of some temples. Whilst wandering over these relics of a wealthy and active population long since passed away, I met with a well of undoubted antiquity and of peculiar construction, being lined with cylinders of terra cotta still in excellent preservation. This Greek mode of forming a well appears to me to be on a sounder, more sensible, and more workmanlike principle of construction than the modern mode of steining wells with bricks or small stones. The internal diameter of these cylinders is 2 ft. 1 in., the uppermost cylinder being a trifle larger; the thickness of the sides is about 1 in. and their ends are thickened to $1\frac{1}{2}$ in., for the purpose of increasing their strength and giving them a better bearing on each other. The durability of this mode of construction is proved satisfactorily enough by the present perfect condition of this example, and that it would exclude impure and superficial springs better than ordinary brick steining must be obvious. Adjacent to the ruins of the city are the remnants of three fine Doric temples. That which is the farthest from the sea is of magnificent dimensions, very little smaller than the great temple at Agrigentum. These temples have been already made familiar by various published illustrations. Their style is somewhat heavy and archaic. The metopes found here by our respected member, Mr. Angell, together with Mr. Harris, are well known to all of us, casts being in our great national museum. They are carved in a lime stone quarried at the Latomia of Campo Bello, seven or eight miles distant, which appears to have supplied materials for much of the architecture of the ancient city, although many fragments of statuary marble are also to be found scattered about. At this quarry I observed the mode adopted of getting out the cylindrical blocks, or drums, for the shafts of the columns. They appear to have been cut, or scappled, out *in situ* from the living rock, the cylindrical blocks being worked to nearly their true size and form by forming a channel, or interval, all round, so as to render them insulated, although still undetached from the rock. The length of each block was, of course, regulated by the depth of the cutting around it, or rather perhaps by the depth of the vertical face of the rock at its escarpment.

In some cases I found these drums ten feet high. By what process they were detached and lifted from the parent rock does not appear from any indication that I could discover. Many of these portions of great Doric columns remain in various stages of completion at the quarry, just where they have lain undisturbed ever since the overthrow of the Selinuntines.* What a picture of retrogression do these appearances present! when the world was not much more than half as old as it is now there existed here a great, rich, and even civilized population. That the people were vigorous and energetic we see plainly by their works; that they were highly civilized we may infer from the character of their art; yet now the silence of desolation prevails amidst a scanty and degenerate people, who allow these remnants of their ancient greatness to lie unheeded. As to Marsala, my next resting place, I have a livelier recollection of its *wine* than of any professional object of research. I have a few notes, however, on the cathedral, which is in an ornate, modern, style, with marble pillars, said (I know not with what truth) to have been originally intended as a present, to the Chapel of S. Thomas à Becket, at Canterbury. It is unnecessary for me to enquire how far these Roman Doric pillars would have consorted with the architecture of that venerable Archiepiscopal pile. From thence I proceeded to Trapani (where is a great fishery for the shells used by the carvers of cameo ornaments), and then to Catalfimi (or more properly Calatafimi), and three or four miles beyond the latter place brought me, over a ragged mountainous country, to the remains of ancient

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* Selinus, founded by Dorians A.C. 628, captured by Carthage A.C. 409.

Segesta. Except the striking and beautiful remains of the one, well-known temple, and part of the external walls of an amphitheatre, the whole city presents a mass of mutilated fragments of worked stone, covering a very extensive area, and baffling all attempts at defining any separate building; never was there a picture of more complete destruction; but it cannot be doubted that an explorer, having abundant leisure and energy, might reap a rich harvest, were he to lay open the contents of the piles of worked stones that have been lying undisturbed for so many centuries.

I will not enter into any description of the temple. Justice has been done to it by Serradifalco and others. I would however remark, that there are unmistakeable evidences of the building never having been completed; its progress, we may presume, was arrested by the utter and final discomfiture of Segesta by the Carthaginians. There are rough bosses projecting from the face of most of the stones of the plinth, left, no doubt, to facilitate the hoisting and setting of the stones, and intended to be subsequently worked off. The shafts of the columns, also, are unfluted, the surface appearing to be left for the flutes to be worked afterwards. We may infer, from these indications, that the practice of the Greek masons was to finish their work in detail subsequently to the erection of the building. Were this practised by ourselves, we should both save expense and gain effect, for it is impossible to prevent a mason from over-labouring his work when done on the banker; but our workmen are too apt to be opiniated, and influenced by routine and prescription. After a ride of about thirty-six miles I reached Palermo; situated in a beautiful bay, and surrounded by the richest country and by, perhaps, as lovely wooded hills as are to be met with anywhere. No traces remain here, as far as I know, of the more ancient inhabitants, but that it was the favorite resort successively of the Saracen and Norman masters of the country is abundantly testified by a variety of existing remains. The cathedral is remarkable for a diversity of styles; with a modern dome, a florid Gothic porch, the rest of the exterior for the most part Norman; such at least is the term which comes nearest to its correct designation, for it was built during the Norman rule, although it is a Norman widely differing from that of the north of Europe. This deviation is probably due to the strong infusion of Saracenic workmanship, which it is easy to account for. The Norman Ecclesiastics, no doubt, would bring their knowledge of architecture to bear upon whatever churches they may have caused to be built when the island fell under the dominion of their race; and the plans of their churches are strictly Norman; but the actual carrying out of the work must have necessarily been entrusted, for the most part, to the Saracenic natives, who were excellent masons, and belonged to a far more æsthetic faith than the rude crusaders from the north. It was natural, then, that much of the ornamentation and many even of the leading forms should savour of Eastern art, both Byzantine and Arabian.

The Royal Chapel, the Church of St. Martorana, and the Cathedral at Monreale, a few miles distant from the city, are, as regards their earliest portions, interesting examples of this modification of Norman architecture, and are in their style generally similar. The walls and other flat surfaces are incrusted with inlaid marbles; their vaultings, spandrels, and soffites, as well as portions of their walls, covered with mosaics of Byzantine workmanship, as is apparent from the Greek costumes prevalent throughout; their arches are pointed, without mouldings or splays; and, for the most part, they rest on ancient marble shafts, no doubt derived from classical buildings, with capitals often imitating, in a rude way, the Roman work. The subject of Saracenic art in Sicily is not in a very satisfactory position. Since a paper in the 21st vol. of the Archæologia, written by myself when but a tyro in the Archæology of our art, and before the existing examples had been critically examined, various writers have treated on the subject who have not, in all cases, had any personal knowledge of the buildings themselves. There can be no doubt that churches I have named are of Christian and

therefore Norman origin, dating from the early to the later part of the twelfth century. But there are two secular buildings, the Zisa and the Kooba, that belong to a very different category.

That they were the palaces of the Saracen Emirs, before the invasion of the Normans, there are, I think, the strongest grounds to believe. The fountains and alcoves, the interior court-yards, the numerous Cuphic inscriptions, all savour of Oriental taste and art, and are identical with the domestic architecture of the neighbouring Asiatic continent. The very name of the Zisa may be identified with the name of a Califf of the tenth century; and as to the Kooba, that is a Saracen word equivalent to a cupola, a covering, or tent; and there are said to be Koobas all over the Moslem world. Roger, the first Norman King, in an existing diploma, speaks with regret of the marvellous palaces ("Palatiorum suorum studio mirabili compositorum") of the Arabs which had been piteously destroyed by their Christian conquerors, and there can be little doubt that during the two centuries of their undisturbed rule in Sicily, the luxurious Arabs erected many such maisons de plaisance. As such they are stated by Smyth to be specially referred to in an Arabic Manuscript, preserved in the library at Monreale. As the residences of the Emirs, these palaces are referred to by other early Sicilian historians, quoted by Farello in the sixteenth century. Alberti, and more recently, D'Agincourt so regards them; whilst Hittorf and Gally Knight do not hesitate to point them out as examples of Saracen art of the tenth century. A certain Benjamin, who visited Palermo in 1173, speaks of the Zisa as one of the marvels of that city built by William; but, as Gerault de Prangey, one of the latest authorities, truly says, it was a common practice in the middle ages to speak of one who had repaired or even greatly embellished a church or monastery, as the *builder* of it. M. de Prangey is an eminent authority on such a subject, and he has evidently referred to these two Sicilian examples with great care and caution. He admits the absence of direct proof, but he clearly leans to a belief in the præ-Norman and Saracenic origin of, at all events, one of them, the Zisa. On the whole, the force of evidence satisfies me that these buildings, which in their exterior are almost identically alike in style, were built during the rule of the Saracens; that they went to decay during the strife with the Normans, and that they were renovated by, and adapted to the use of, the Norman conquerors, when those interior works were done which so closely resemble the Siculo-Norman portions of the churches to which I have adverted. The beauty of their situation could, with difficulty, be parelleled, and such indeed appears to have been the opinion of the builder: for, inscribed in large Cuphic characters along the parapet of the Kooba, are words which are stated by Smyth to have been translated thus:—Europe is the glory of the world;—Italy of Europe;—Sicily of Italy;—and the adjacent grounds are the pride of Sicily."—Lying among the wooded hills to the east of the city is the Benedictine Monastery of S. Martino; a magnificent modern structure of great beauty. The library especially is large and handsome, and the principal staircase, rich in polished marbles and alabaster, is one of the most striking features of this very noble building. A less indulgent critic, in the interest of morals rather than of æsthetics, might suggest the incongruity of this display of art and decorative luxuries in a building dedicated, not so much to the service of God, as to the domestic uses of a religious community professing a rule of self-denial, and an abnegation of all personal enjoyments.

It seems probable that to secular pride, and a spirit of rivalry with some neighbouring ecclesiastical establishment, we are indebted for many such great works in connexion with the Church, and its various orders and endowments. A showy picture in the hall represents a colossal S. Martin, mounted on a prancing charger, and cutting off the skirts of his crimson cloak for the benefit of a prostrate beggar, not without a certain air of swaggering and vain-glory. About 3 miles north of Palermo is La Favorita, a royal residence of most fantastic character, both gardens and palace being strictly

Chinese. I need not dwell on this elaborate toy, but I cannot refrain from noting, that so anxious did the royal occupant appear to be to disincumber himself from the presence of servants, that his dining table was contrived so that the dishes and plates should rise and descend through apertures in the floor; thus when a fresh course had to be served, a bell was rung, the dishes disappeared downwards, and after a short delay rose again with their varied burden of fresh delicacies. About 8 miles south of Palermo, is La Bagharia, a village where many of the Palermitan nobility have their pleasure houses. That of Palagonia is a remarkable specimen of the grotesque. The quantity of marble sculptured into deformed figures, uncouth animals, and shapes that defy all natural classification, is almost beyond conception. The ceilings of the principal rooms are of looking glass, and the same material completely lines also the walls, together with polished marbles, agates, and jaspers. As a specimen of the affectation, not very uncommon in Italy, of attempting to make their furniture the vehicle of a sentiment, the following inscription appears on one of the walls of this palace:—

"Specchiati in quei crystalli e nell' istessa
Magnificenza singolar', contempla
Di fralezza mortal l'imago espressa."

In the library, I took note of an easy chair, which was readily convertible into a short flight of steps for reaching the upper shelves, a contrivance which I have occasionally since seen attempted nearer home, but never, I think, so successfully as in this piece of Palermitan joinery.

At the villa of Prince Butero, the chief curiosity was a large building in the gardens, called La Certosa, being in fact, a counterfeit convent, with its separate cells arranged exactly after the manner of such establishments; these cells containing monks of wax-work worthy of the atelier of Mde. Tussaud, and each cell provided with bed, seat, table, cooking apparatus, books, &c. I never have seen elsewhere a baby-house on so colossal a scale! I have some recollection too, of waxen representatives of *nuns*, as well as monks, occupying those cells in most uncanonical companionship; but so preposterous a divertisement for the amusement of the princely owners seems incredible, if I had not found it recorded in my note book. Another curiosity, but of a very different character, is the burial place of a Capuchin convent near Palermo. It consists of various galleries of considerable extent. There are twenty-five small chambers leading out of these galleries into which bodies are placed on their first arrival, and where they remain six months shut up for desiccation by heat. When thus prepared, the bodies are brought out, like dried mummies, and clothed in their ordinary costume during life; priests in their canonicals, monks in the habit proper to their order, and so on. The shocking looking objects so dressed up, are then placed in a standing posture, each in its niche. Nothing can exceed the hideous deformity of the spectacle presented by the avenue of niches, so tenanted, on either side of you as you pass along the galleries. Each body is held up in its place by a cord round the waist, attached to the back of the niche. But this cord by no means always suffices to support them in an upright position; the ligaments of the limbs gradually yield to the weight of the body, which consequently falls, or rather stoops forwards, and is prevented from falling down only by the cord; the ghastly head droops downwards or sideways, the dark brown countenance looking truly frightful; the arms, too, droop, and the legs give way under the weight which they are no longer fit to support. Under each niche are written on a tablet the name, age, and period of death of the individual it contains. The miserable remnants of mortality thus exhibited present a combination of the ghastly and the ludicrous, which, I suppose, could hardly be equalled. Certainly the bad taste of the exhibition may well be supposed to be without a parallel; unless, indeed, it be found in Rome, where at the cemetery of a Capuchin Convent, near the Barberini Palace, are vaults containing niches tenanted by the bodies of the dead

brethren preserved with the skins on, and clothed in their ordinary dress. The roofs of these vaults are ornamented with human bones formed into panels and pateras, and are lighted by lamps shaped out of the bones of arms and legs symmetrically arranged and adapted to this new, posthumous use.

I have now cursorily touched upon some of the chief objects of interest or curiosity that attracted my attention. Although my stay in the island extended over two months, and my whole time was spent in constant activity, I felt regret at leaving its shores, for my visit had been one of highest interest. My regrets were further enhanced by the conviction I felt that much remained unseen. The coast road from Palermo to Messina remained unvisited, including Cefalu, Tyndaris, and Termini, where, besides what has already been made known, I cannot doubt but that there is still much of antiquarian interest to reward the researches of future explorers. But reports reached me of some thirty Fiumi that had to be crossed, and of the almost total absence of bridges over them. These Fiumi, be it remembered, although dry ravines in the summer, are very formidable torrents during the two or three wet months of the year.

As to the interior of the island, all accounts agreed in describing it as devoid of architectural interest; few buildings of the best periods having survived, it is said, the ravages of the frequent earthquakes with which this beautiful island has been for so many centuries afflicted. I was still further deterred by the reported absence of roads and inns, evils for which, not nature, but man, alone, is answerable. Still I have always regretted that I did not make any exploration inwards, and I strongly recommend those whom the altered circumstances of the country may induce to visit Sicily to traverse its little known central districts, where I feel convinced that there is a rich harvest still unreaped. Such a student will do well to provide himself with a sound and correct knowledge of the early history of this remarkable country and of the races which have successively, and even simultaneously, occupied it. He will find traces more or less distinct of at least eight populations; namely, Celtic, Greek, Punic, Roman, Ostragothic, Arab, Norman, and Italian. Perhaps no country of like extent in the world has derived its population from so great a variety of sources. But if antiquarian and artistic wealth lie concealed in this shattered island, how infinitely richer are the hidden and unheeded sources of physical wealth. Although the cultivation of the soil is most primitive and imperfect, and although the nature of the tenure on which land is usually held there is most adverse to agricultural improvement, yet it is still a land abundant with corn, wine, and oil. Capt. Smyth, who knew this country intimately, pronounces it to be "one of the most fertile spots on earth."

Untold wealth in flax, timber, sulphur, marble, and no doubt very many other natural products only wait the capitalist and merchant. Of the article I have last named, only the white veined marble finds its way into this country, yet various coloured marbles and jaspers of great beauty are produced, and were, we know, duly appreciated and much used by the architects of ancient Rome in its best days.

The following may be named as the localities of some of them, as furnished to me by an intelligent mason at Palermo.

Marble di Trapani of a grey colour.
Marble de Castelnuovo of a yellow colour.
Marble di Segesta of a yellow colour.
Marble di Taormina of a red colour.
Marble di Parco of a yellow colour.
Marble d'Ogliastro of a red colour.
Marble di Castelaccio of a grey colour.

The two last named marbles are readily obtainable in blocks 12 or 13 feet long. Specimens of

some, if not of all these, I found included in the fine collection of polished marbles made by the learned and amiable Avocato Corsi, of Rome, which collection was subsequently brought to England and exists now, I believe, at Liverpool. Each specimen it contained is no less than 8 Italian inches long, 4 in. wide, and 2 in. thick, and is highly polished all round. It comprises ten varieties of agates, a mineral in which Sicily is so rich that one of its rivers, the Achates, is supposed to have given to it its name. There are also at least eighteen varieties of Jasper, in which beautiful substance Sicily is stated by Corsi to be more abundant than any other known locality. A recent writer has stated that there are no less than fifty-four varieties of Sicilian Jasper. That a trade has not been established in these precious productions can only be due to the want of enterprise and capital in the island, a want easily accounted for by the long continued course of wretched and degrading misgovernment. What may we not hope for from the country when it shall have firmly established its political freedom, and re-entered upon the path which freemen alone are destined to tread. The present apathy, indolence, and ignorance of the people will, it is to be feared, oppose many and heavy obstacles to the re-establishment of a durable and prosperous administration. But such was not always the character of Sicilians. When in early times Palermo was besieged, the patriot women are said to have given up the hair of their heads to serve as the bowstrings of their gallant defenders. May we not then reasonably hope that in the councils of Providence, it may be permitted to this ancient people to vindicate for themselves some portion of that moral and material eminence which their forefathers of old so worthily achieved.

The Chairman, C. R. Cockerell, Esq., R.A., President, said he was sure they would all be delighted, more especially those who might be called ancient Sicilians, like himself, at the description which Mr. Smirke had given them of that island. Mr. Smirke had boasted of having been there some thirty years ago. He, himself, called that nothing, for he was there forty-eight years ago. Mr. Smirke had described in a most interesting manner the remains of Sicilian art, and no doubt if he had told them some anecdotes of his own more recondite mysteries they would have had still better amusement. Sicily was not backward in its anecdotes of the ancient Romans, some of them of a humorous character. They might remember the story of a gentleman of Agrigentum, named Gelon, who received on one occasion fifty knights who had been caught in a shower, and were drenched to the skin. He not only entertained them, but furnished them all with cloaks, so that they were all harboured in his house, and well fed, and clothed and sheltered. This gentleman afterwards went as an ambassador to a city called Leontine, where his fame had gone before him; although the place might be termed the Geelong of Sicily, and the people crowded to the theatre to see him. When he made his appearance everybody got up to look at him. Now this worthy man was not so remarkably favoured by nature as he was by fortune, and he felt that those who beheld his person were not particularly gratified, and that they looked upon him with less respect; he therefore, exclaimed, "Gentlemen, do not be astonished to see me here. My city husbands its fine looking, handsome fellows as ambassadors to great cities; but for small and insignificant cities they employ small persons like myself." Mr. Smirke's suggestion of the use of coke was a curious one, and he could not help thinking it would be a practical one in this climate. For this, as well as for his kindness in submitting so valuable a paper, they were much indebted to him, and they would all unite in voting their thanks to him.

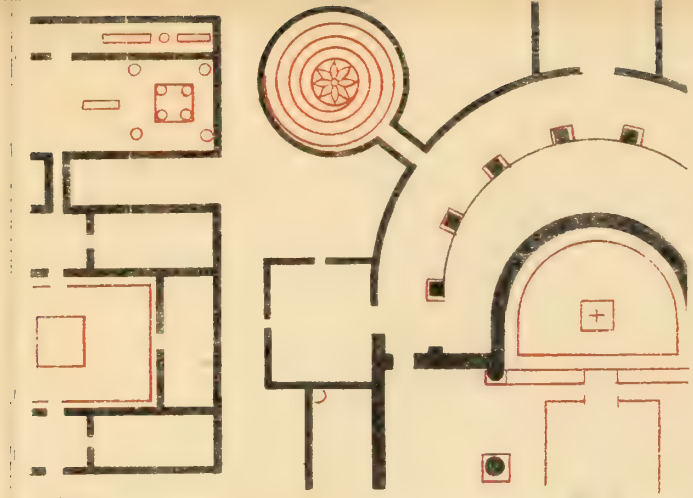
Mr. H. Roberts, Fellow, expressed the pleasure with which he had heard Mr. Smirke's paper, many of the incidents related in which, especially the personal discomfort of travellers, he could confirm by his own recollection. The suggestion of the use of coke was valuable in reference to fire proof construction.

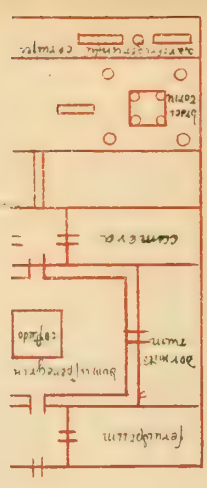
Professor Donaldson, V.P., thought the suggestion should be referred to the Committee of Construction, and that some experiments should be tried, instead of passing the matter by with a casual observation. He had visited Sicily himself, and spent two weeks under the walls of Syracuse in quarantine. The island was a mine of antiquarian wealth. There were a great number of tombs still unopened, and numerous vases and decorations were discovered day by day. He knew Sig. Politi, 40 years ago, and had the pleasure of recommending him as an honorary and corresponding member of the Institute; and he thought it would be well if they were to send him a letter now to congratulate him upon his altered position. Sicily was very abundant in coins, of which a beautiful series had been found, and which illustrated the wonderful productions of a great people. They might remember that Cicero, speaking of the emulation of the works of art which Verres carried away from Sicily to Rome, gave a magnificent idea of the artistic wealth of Sicily. Monreale was an extraordinary and remarkable monument, and indeed, you could not go to any part of Sicily without meeting with a number of most interesting antiquities. The Sicilian element of the Greek Doric was very well illustrated, and when he was making his designs for the supplemental volume of Stuart's Athens, he was very much indebted to the Chairman's researches in Syracuse, especially the fortifications of the city. Indeed, the whole of Sicily was highly interesting, and was well worthy of some months residence by some of the students of the Institute, who might furnish information of the highest interest with regard to the development of Greek art.

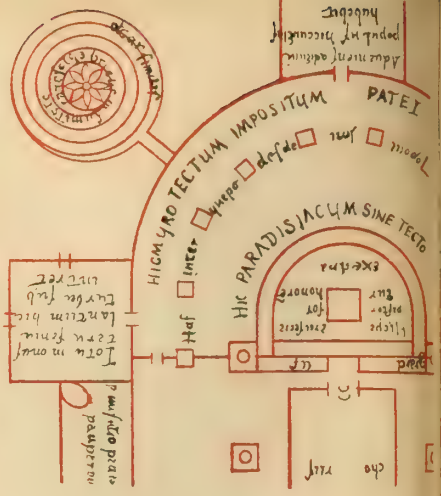
Mr. Mylne, Fellow, fully concurred with the preceding speakers as to the character of the paper they had heard, and took occasion to refer to a collection of Drawings exhibited on the wall, and made by his grandfather about 110 years ago, he being at that time a Student at St. Luke's, in Rome. They were part of a much larger collection, comprising a series of from 150 to 200 drawings, extremely elaborate and carefully worked out, especially the restoration of the theatre.

Mr. Smirke remarked that the series of Drawings referred to by Mr. Mylne, had not only the merit of much apparent accuracy, but had also a kind of historic interest, for they claimed priority over the works of Stuart, which were published some years later. He thanked the meeting for the attention they had so kindly afforded to his paper, which was but the jottings from his daily journal, and that must be his apology for its very miscellaneous and multifarious character.

The thanks of the meeting were unanimously voted to Mr. Smirke.—Adjourned.



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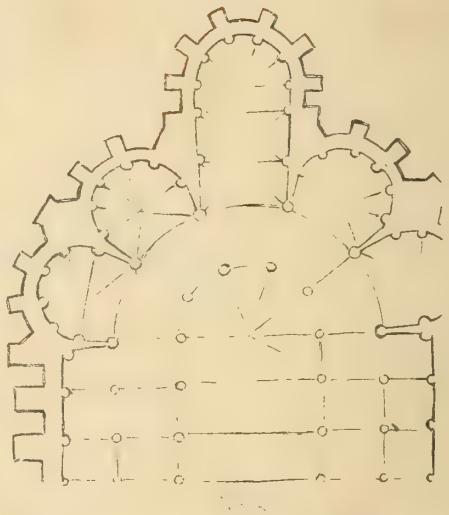

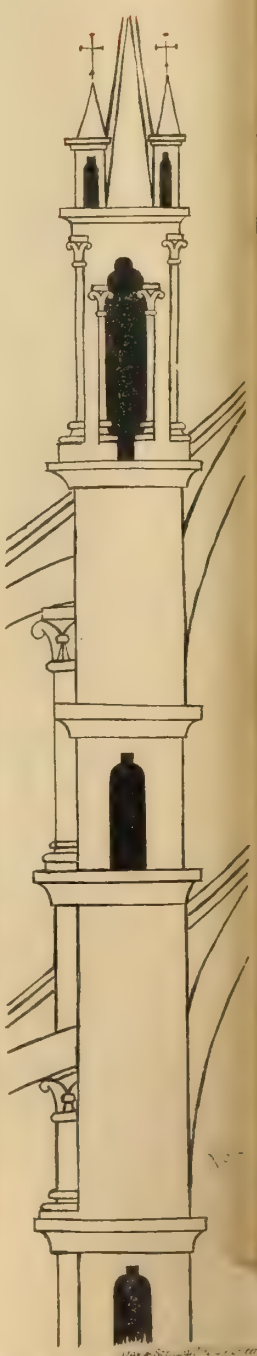

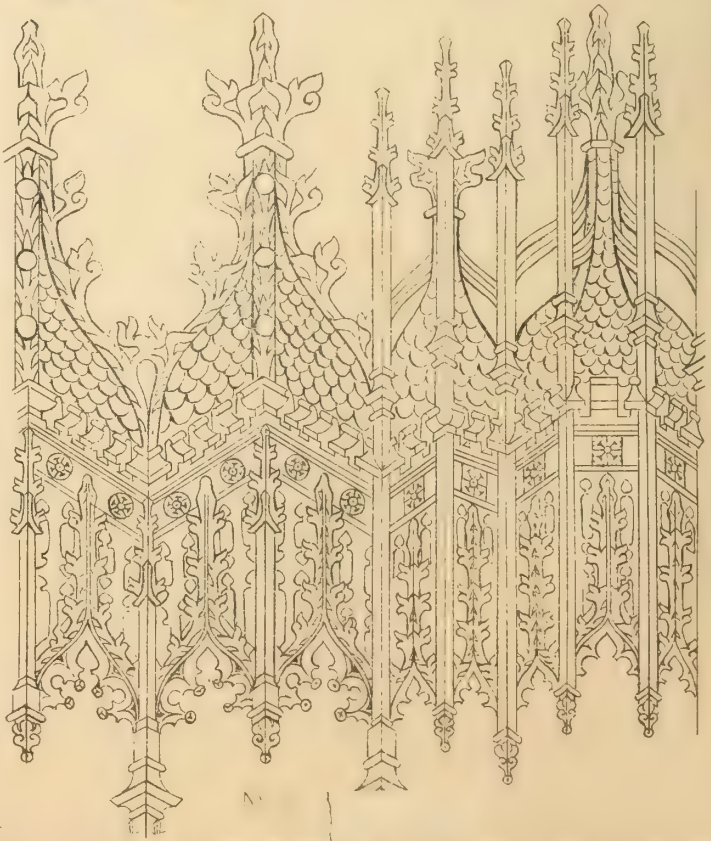

ARCHITECTURAL DRAWING.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, 19th Nov., 1860.

By W. Burges, Fellow.

In giving the usual paper which is very rightly expected of every new member of this Institute, it is not without some little misgiving that I have selected the subject of architectural drawing. I feel that I ought rather to have tried my hand upon one of those stock subjects, viz., architectural colour and mosaics, on which so much is to be said, but which we have seldom or never the means of putting into practice, either from the disinclination of our clients, as in painting, or from the want of materials and special artists, as in mosaic. In the meanwhile, whenever we do get the opportunity, the result is generally a failure, partly because no rules will ever teach a man the value of one tone of colour as compared with another, and partly because we require in this case to be taught by repeated failures as to what combinations of colour look well, and what look ill. Under these circumstances, therefore, it has struck me that it may be more useful to bring together a few notices of a much less ambitious branch of the arts, but which, however, is of the most vital importance to us architects, inasmuch as it exercises more or less influence upon the design of the building itself; and we all know that although the building is but the skeleton for the additions of painting and sculpture, still, if that skeleton be bad or deformed, no satisfactory result can ever arise, even with all the painting and sculpture in the world. I venture to assert that the manner in which a man draws, does and must affect the nature of his design more or less. Thus, if he use strong thick lines, he will, in all probability, be induced to make his design massive and simple, and not give way to the vanities of crockets and pinnacles, because he will find that he has hardly got space to get them in. He likewise sees his design in its most severe and unfavourable light, and ten to one the building will turn out much better than the drawing, to the advantage of every one concerned. If, however, the architect draws in a moderately thick line, and puts in the stone joints and etches the walls (I am now speaking of elevations, &c.), he simply deceives not only his client, but still worse, himself; for the building is almost sure to come out worse than the drawing, the joints, roughnesses, &c., not, of course, showing in new work. As to the third style of drawing, with very fine hair-like lines, relieved by what is termed back lining, whereby small fillets are made to look like hollows, and hollows like fillets,—this style, in fact, is scarcely worth mentioning, for it means nothing, and hardly anybody employs it in the present day; and, indeed, one is almost tempted to believe it to have been invented by some instrument-maker. I may likewise observe that it was generally employed in the worst days of architecture.

And now concerning the way in which our ancestors drew. It is generally believed that very few drawings have come down to us from the middle ages, but, thanks to the labours of the French and German antiquaries, we have a very fair catalogue of drawings of all ages, besides published *fac-similes* of a tolerable proportion of them. In the Dictionary of the Architectural Publication Society, under the word "drawing," will be found an enumeration of the more famous of these, to which might be added the numerous designs and drawings scattered up and down in the collection of manuscripts and prints of the various museums in Europe. Instead of going through the whole list given in the "Architectural Dictionary," the majority of the drawings mentioned in which I have not seen, and which I should have to describe second-hand from books, or else to confine

myself to noticing the fact of their existence, I propose to touch upon those, the *fac-similes* of which are published in books within every one's reach, and upon others which I have examined myself at leisure.

I believe nothing whatever is known of the architectural drawings of the Greeks and Romans. The "Lapides Capitolini," containing a plan of Rome, are simply inscribed on marble, and formed anciently part of the pavement of the Temple of Romulus and Remus: and the light and beautiful architecture painted on the walls of Pompeii was never, that I know of, resolved into real materials. Our series of drawings then opens with the plan of the Monastery of St. Gall, now preserved in the library of that establishment. It was first published by Keller, at Zurich, in 1844, and republished two-fifths of the real size in the fifth volume of the "Archæological Journal," p. 87, with a most excellent notice by Professor Willis. The plan, which is drawn in thin red lines upon a large sheet of parchment, with inscriptions all over it, showing the uses of the different parts of the building, was sent, as one of the said inscriptions informs us, for the use of the Abbot Gospertus (who began to rebuild the church and monastery in 829), by some anonymous friend, who is supposed, with some reason, to have been Eginhard, the son-in-law of Charlemagne, and who held the office of prefect of the royal buildings. However this may be, the plan presents us with a very complete monastery, with its great church and accompanying buildings. The red line not only seems to mark the external and party walls, but also to indicate the furniture, such as benches, tables, stoves, &c, requisite to each building. The plan, as Professor Willis very properly remarks, is not done to scale, but certain figured admeasurements enable us to form some idea of the sizes of the various parts. The church would appear to have been a most noble building, with two apses and their paradises or semicircular walks. The western one was further enriched with two circular towers.

The winding stairs of these latter are shown as gradually winding round from the circumference to the centre, like a section of a snail's shell. It is doubtful whether a common winding staircase is thus represented, or whether it was really an inclined plane which went from the circumference to the centre, and so on to an upper chamber, where there was an altar, in one case dedicated to St. Michael, and the other to St. Gabriel: would there, supposing the latter supposition to be correct, be space to hang the bells in the space between the newell and circumference in the upper part of the tower? The ornamental finial at the top is shown on plan as finishing the newell.

The arches of the cloisters and the crosses of the altars are shown by elevations in their respective places on the plans,—a mode which still obtains in Turkey at the present day among the distinguished native architects who have the honour of working for his Imperial Majesty the Sultan; so little have things changed in the East. Another peculiarity in the St. Gall plan is, that sundry squares are drawn in the middle of court-yards and of buildings. These, as Professor Willis suggests, may be either indications of the classic atrium with its uncovered impluvium, or a sort of upper lantern rising above the roof, and giving light by means of clerestory windows; both these explanations are very feasible, and both probably were intended in the original. Lastly, Eginhard, or whoever was the architect, wrote certain explanations in Latin verses on various parts of the drawing. Fancy that most matter-of-fact production, a modern plan, ornamented with metrical directions to the builder.

The next drawings to be noticed are those incidental pieces of architecture which occur in the Anglo-Saxon MSS., in which the British Museum is so rich. It is true that they are generally ill-drawn; but still they show us enough to enable us to draw very valuable conclusions as to what Anglo-Saxon architecture really was, and to refute the generally-conceived idea that both architecture and history began in England exactly in the year 1066. Mr. Wright has contributed a most

interesting paper on the subject in the first volume of the Transactions of the Archæological Institute. In it he shows that the triangular arches, and the balluster shafts, which are now recognized as Anglo-Saxon features, occur equally with representations of domes, and carved capitals, pinnacles (not crocketed), and iron work, most of which antiquaries are generally unwilling to acknowledge as belonging to the time before the Conquest; as if the countrymen of Alfred and Edgar, both great and powerful kings, should have been unable to carve a capital or use a chisel, when they were renowned all over the world for their manuscripts, jewellery, and embroidery. I suspect the fact is, that the history of architecture has been hitherto written in far too scientific a manner; and because the art exhibits a general progress and decline, people have believed that sundry processes were unknown at certain periods; when, in fact, almost all the essentials of buildings have remained the same since the first ages. Thus, because Gervase says that the work of the old cathedral at Canterbury was done with an axe,* and the new with a chisel, we are to suppose that the Saxons had no chisels and no carved ornaments. Now the MSS. distinctly show us elaborate capitals which must have been done with a chisel; and no one can for a moment imagine that so useful and obvious an instrument could ever have been lost even in the most barbarous countries, much less so among the civilized Anglo-Saxons. We owe also to Mr. Wright the first doubt as to the date of Waltham Abbey church. Hitherto most antiquaries believed it to be of the date of Henry I., —first of all, because it was like the architecture of that time; secondly, because the two queens of that king were great benefactors to the establishment; and thirdly (and here was the rub), because it was more ornamented than any known contemporary Norman or Saxon building. As if Harold, the richest and most powerful man in England, could not have given orders for a rich building to be erected, or had not the funds to carry it out. I do not deny that he might have employed foreign workmen, but it by no means follows that these foreign workmen must have come from Normandy. Harold and his family were very properly anti-Norman, and it is just as likely that he got his workmen from Flanders or some other part of the Continent as from Normandy.

The next document I shall bring forward is a view of the church and monastery of Canterbury, contained in the magnificently illuminated Psalter of Eadwin, now preserved in Trinity College, Cambridge. This very curious drawing, which is made to do duty both as plan and elevation, has likewise received the elucidation of Professor Willis, to whom I may venture to say the literature and some parts of the practice of our art owe more than to any one else. The way in which the plan and perspective are made to co-exist is by making a vanishing point in the centre of each court, so that there are three or four of these vanishing points in the drawing. The two towers which we saw in the plan of St. Gall here reappear, although in different positions. All the water-courses and drains are shown, and upon the whole, considering the very original perspective, it may be pronounced to be a very accurate drawing; indeed, Professor Willis tells us that wherever a building is shown on this plan, Romanesque work is more or less found at the present day at Canterbury. I have not been able to see the original of this drawing, but the notice in the "Vetusta Monumenta," where it is engraved, assures us that it is coloured.† As a drawing it is curious, as showing the complete development of the practice of drawing elevations upon plans, as at St. Gall. I think, however, that we must consider this drawing of Canterbury more in the light of a survey for the purpose of showing the system of water-courses than as a document to be worked from. In all probability such documents

* See Willis's "History of Canterbury Cathedral." It is surprising that this book has not been more popular with the profession. It is the history of the building of a church, or rather of the choir of a church, during the very best period of art.

† "Vetusta Monumenta," vol. ii.; the original is in the Library of Trinity College, Cambridge.

would not be very common, and when the work was done the erasing knife of the writer would be brought into use, and the parchment or vellum, which was very valuable in those days, and which, by the way, is not very cheap in these, would receive a new employment. That this was the case we know from the discovery made by MM. Varin and Didron, in 1838, of a design for the west end of a cathedral, besides several details, and which they found under the writing of a manuscript containing a list of the deceased members of the chapter of the cathedral of Rheims. Now the last entry is 1270, and the drawings were executed in all probability some time before. They have, according to M. Didron's account in the fifth volume of the "Annales," been first sponged out and then scraped over, to obliterate the lines, and finally cut into leaves. However, enough remained to enable M. Didron, assisted by the late M. Lassus, to produce engravings of several portions, which will be found equally in the same volume of the "Annales." M. Didron assures me that the lines are very thin, which is not to be wondered at, considering the treatment they have undergone.

The principal composition shows a façade for the west end of a church, with the usual three portails, and the somewhat unusual feature of a large window above. It is either an unfinished production, or one for the use of the architect and his workpeople alone, for as little as possible is shown. Thus, only two or three crockets are shown at one side of each of the great pediments; no ornament or figure is shown in the voussoir; the left hand corner is, indeed, more worked up, but the artist has made up for it by showing nothing at all on the right. The whole composition appears to me to want somewhat of severity, and I hope it was sponged out, and never executed on this account. Another plate shows part of what M. Didron thinks is another portail, but which might possibly represent the return angle of the former drawing. It is remarkable, if really a portail, for showing the outer plane of the centre door as filled with tracery; if this be really the case, it gives us an arrangement somewhat similar to what obtained in the west front of the now destroyed church of St. Nicaise, at Rheims. M. Didron thinks that the architect, being hard up for room, drew in the tracery of the window, but to a different scale to what the portail arch was drawn; but if even that were the case, a window would hardly have its centre light twice as broad as its side ones, which this has. Below this portail are three pieces of ornament, each drawn in between borders, composed of six lines each. What these six lines mean I am totally unable to decide, unless they represent in a sort of shading, the rounded edges of the boutells on either side of the great hollow in which they are placed; but I certainly cannot agree with M. Didron's suggestion, that they may be the lines of the musical scale, and as the outer parts of the ornament are occasionally drawn upon them, and of course go up and down, so we have a sort of architectural music.

Willars de Honecourt, the fac-similes of whose sketch-book are in the hands of everybody, is the next on the list. So much has been said and written concerning these drawings that I shall very much curtail my description of them, which would otherwise have been long, considering that these are the most perfect and the largest collection of the drawings of the Middle Ages which have come down to us; and first of all I must claim Willars for our profession, as some attempts have been made to hand him over to the sculptors and painters, because, forsooth, he drew the figure too well and frequently. There is one fact, however, which completely, so far as I see, upsets this theory, and it is this—the tendency of an artist, either painter or sculptor, or architect, would be to sketch details which would come in useful to him. Thus the painter and sculptor would draw parts of the human body, bits of costume, anatomy, &c.; while the architect, on the contrary, would draw mouldings, capitals, foliage, &c. Now, in the sketches under consideration we do find the capitals, foliage, and mouldings, but we do not find studies of hands, of feet, of anatomy, &c.; but, on the contrary, there are a number of problems only useful to a man engaged in actual

building. The sketches were first made with a leaden or silver pencil, either of which would perfectly mark on the vellum. If the subject were an architectural one, the straight lines were ruled, and the circles put in with a compass, one end of which had a leaden point. These lines were afterwards gone over with a blackish brown ink, by means of the hand alone, no instrument being employed. Upon looking again at this MS. two months ago, I was struck more than ever by the extreme precision of the touch; there is no faltering or wavering, but the line is just as thick and as firm where it ends as where it begins. Again, in drawing things in small, mouldings and foliage become simplified so as not to break up the breadth of the composition. Clearness is got by blacking hollows where they occur, and the grounds of ornament, such as capitals, &c. The walls of the plans, however, are not etched, and we shall find this practice obtaining even in the time of Thorpe, the majority of whose plans are not etched, although not devoid of colour. One would imagine that Willars might have etched them up with his leaden point as he often did his drapery; but nothing of the kind occurs. Another peculiarity of our architect was, that, when he copied any executed work, he copied it not as he saw it, but with variations of his own, and as he would execute it himself; thus the window at Chartres is considerably altered in order to get more space for light, while that at Lausanne is so much so that it can hardly be recognised. But with all his peculiarities, Willars presents us with a decidedly good style of drawing, and which, it strikes me, might eventually be developed into something much better than that in use of late years. I mean, that we should join our improved knowledge of perspective and of the figure to the energy, simplicity, and firmness of our confrere of the thirteenth century.

The fourteenth century affords us the drawings of the Cathedral of Cologne. These I saw some ten years ago, but so far as I remember, I was told that the originals were in the architect's office, and that what I saw were copies. It is true that they, besides several others, have been published both in Germany and France, but I must confess that I should be sorry to deduce any theories as to thickness of line, &c., from the fac-similes made by the Germans, who have an abominable mode of publishing almost everything in the finest possible lines, exactly like Pugin's Specimens and other works of that period, thereby depriving them of all vigour, and producing a very false impression.

The fifteenth century being nearer our own time, presents us, as might have been expected, with a greater number of drawings. First, we owe to Professor Willis the explanation of the legends attached to the section of mouldings from the door of the church of St. Stephen's, Bristol,* made by William of Worcester in his Itinerary, preserved at Corpus Christi College, at Cambridge; but the most interesting to us as Englishmen, are those drawings for King's College, Cambridge, now in the Cottonian collection of the British Museum. The first† of these shows the east and north sides of the chapel in perspective, *i. e.*, the north side is drawn parallel to the horizon, almost in elevation, while the lines of the eastern go to a vanishing point. The drawing is partially coloured, and is especially curious, as showing a small half-timbered building at the eastern end, with a flêche containing a clock-face. The details of the architecture are very well made out, and there are ruled lines, like a modern drawing. No figures are shown in the niches, and the rain-water is carried off by regular pipes, as in the present day. Curiously enough, similar leaden pipes are to be found in those parts of the Cathedral of Beauvais erected at the end of the fifteenth century; but in this latter case they are elaborately tinned with powderings of *fleur-de-lys*, &c. Although this drawing has a look of having been subject to a great deal of wear and tear, and of having really been used by work-

* Published in the Transactions of the Cambridge Architectural Society.

† Cott. Aug. 1, vol. i. 2.

men, I am afraid that its general appearance is rather of the sixteenth than of the fifteenth century. Another drawing* shows us the tower intended to have been erected close to the same building. As an architectural composition it is of no great value, having several stages with a small window in each, and an octagonal buttress at each angle, which buttresses finish in spirelets. The drawing is executed in ruled black lines, and has a wash of blue colour, more or less deep, all over the building. The hollows of the mouldings are not blacked in, but etched, which is the next best thing, although rather a dangerous one; for a contractor on one occasion actually mistook the etched hollows in a drawing I gave him for dog-teeth, and estimated them as such. Of course, when the amount had to be deducted from the estimate, the dog-tooth ornament was not allowed too much for. I should mention that this drawing of the tower of King's College is in perspective, although of a very unsatisfactory kind, for, among other things, the whole of the four spires find themselves at the same level at the top of the drawing. Another design,† of about the same period, is that for a gallery for Henry VIII.; this, likewise, is in perspective, and runs diagonally across the page. It is drawn with the free hand in black ink or pigment, but one or two of the longest lines have been ruled. It is likewise shaded up in black, and locally coloured with thin washes, like those I shall presently notice in Albert Durer's works. It is a very careless drawing, and the style is a sort of bad Germanized Renaissance, with baluster columns, &c.

A later drawing‡ is contained in the same collection, the date of which would probably bring us to Edward VI. or Mary. It is the façade of a house, almost in what is now called the Italian style, but with Renaissance details. The perspective is very fair, the vanishing point being in the middle of the building, so as to show the projecting wings and the external staircases in perspective. The composition, also, is by no means deficient in picturesqueness; but we can hardly praise the colouring, which, with partial shading in black or grey, presents us with a bright body-colour cobalt roof, and bright vermillion casements to the windows.

Before leaving the MS. Room of the British Museum, I must notice one or two drawings there deposited. The first§ is a design in perspective for a large and complicated tent. The plan may be described as like that of Canterbury and other cathedrals, viz.,—a cross with two transverses. The drawing is made in black lines, is tinted up with brown, and the ornaments touched up with yellow. The book known as Aug. 3, Cotton, presents us with several other tents, and a Renaissance fountain, the latter also in perspective, and tinted up with black or gray. It is valuable to the artist as presenting him with several very large coloured figures of the costume of the time of Henry VIII.

The third drawing‖ is a design for the tomb of Henry VI., which Henry VII., who revered him as a saint, had, it appears, intentions of erecting at Windsor. The execution, however, does not appear to have come off. The design is in bad perspective, as usual, but drawn very carefully, and probably with a ruling pen. The circles and arches also appear to have been done with a bow pen. The ink is a sort of dark sepia; it is also shaded very neatly and carefully with the same. There are no figures shown in the niches, and the line of impenetration above is distinctly shown, whereas in some of the German drawings, if we may believe the engravings, the mouldings in similar cases are simply drawn as ending in nothing.

The Society of Antiquaries have published also in the "Vetusta Monumenta," vol. IV., the drawing representing the funeral of Abbot Islip. This very curious roll of vellum, which is preserved in the Herald's College, is of great value both to the antiquary and to the architect, as it

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* Cott. Aug. 1, vol. i. 2. † Cott. Aug. 1, vol. i. 4. ‡ Cott. Aug. 1, vol. i. 5.
§ Cott. Aug. 1, vol ii., 76. ‖ Cott. Aug. 2, vol, i.

presents us with sundry views of the interior of Westminster Abbey before the Reformation. The lines are thin and the execution delicate. From it we learn what statues adorned the altar-screen, and what statues were placed above it. The dossel, exactly the most curious part, is represented as being covered up; but the brackets on the pediment of the wonderful tomb of Aymar de Valance are shown to have supported angels. Again, the blank wall space in the chapel over Islip's Chantry, where now the wax work is deposited, had a large picture of the "Crucifixion;" and another part of the roll presents us with the screens, now destroyed, which divided the chapels of the north transept from one another. Nothing can be much better than the drawing both of the architecture and of the figures in that roll. I may mention as another proof of the value of documentary evidence relating to the same building, that the manuscript life of St. Edward, written in the thirteenth century, shows us what figures were placed on the twisted columns at the western end of the Confessor's tomb. It appears that they supported statues, and if we may believe the MS. coloured or enamelled statues of the king and St. John.

I must now take you to the Print-room of the British Museum, to examine the drawings of two of the greatest artists the world has ever produced, for we shall here find drawings made by Albert Durer and Michelangelo, both great in all the three arts, as I hope some day may be the case again with our profession. This day, indeed, will not come in our lives, but still we must do our best to help on the good time, and, instead of fame, take the consciousness of having done our duty as the reward of our exertions. First of Albert Durer, for he closes one great period of art. In the Print-room is a very large square folio volume, nearly filled with drawings by this master; at all events, they are attributed to him, although I have always had my doubts how ever Albert Durer, although aided by great industry and a scolding wife, could have got through even one half of the work attributed to him. His drawings are done in moderately thick lines, either with black or dark brown ink, and betray most certain traces of compass points, ruling pens, and bow pens. The first drawing I shall notice is the plan, looking down from above, of a most complicated fountain or pinnacle; there are pinnacles and pediments with an S-shaped plan, and, indeed, it resembles the almost impossible architecture that Israel Van Meekin designed on paper, and Adam Kraft executed in stone.

There are many compass-holes in this drawing, as if it had been pricked off. It is most carefully done, and the sections of the mouldings have the beads turned in with the bow pen. The lines of operation, such as the centre lines, are simply scratched on the paper, as it does not appear that they had means of erasing the lead lines. We shall see John Thorpe doing the same thing. Another drawing represents a tomb, evidently Italian, beneath a vault, supported upon four pillars. This drawing is done in black, and elaborately shaded with the same colour mixed with white: the lines are ruled.

There are likewise designs for sundry pieces of jewellery. These are outlined in black or dark brown, and then very slightly coloured with light washes of colour, the raised parts being left white. One design would appear to represent a large vase or fountain of the most elaborate description. From it the various figures pour out streams of liquid, which, as it is coloured red in one case, I suspect to represent wine. There are two hands, a little below the middle, which hold out cups similar to those attached to the drinking fountains of the present day, to receive the noble juice. Indeed, this design would make a most charming drinking fountain, if executed in copper and enamelled, or, indeed, even in stone, painted; and I should be very much inclined to recommend it to the notice of the Drinking-Fountain Association, whose designs certainly, to say the least, afford some margin for improvement. But to return to Albert Durer. Three or four leaves of the book are occupied with a

coloured design for baluster columns covered with arabesques: the drawing is most vigorous, and the colouring leaves nothing to be desired. The other drawings are more remarkable as curiosities than as having relation to architecture. Thus there is the figure drawn from the model which he afterwards used in his beautiful plate of Fortune. The original figure is covered over with squares drawn with a sharp point, evidently for reducing or enlarging it. At page 143 is a bird remarkably like the dodo, and further on a full-size elevation and plan of a shoe of the period,—a most valuable drawing for the writer on costume. Durer, in fact, appears to have had all the conveniences and appliances of modern times as regards his architectural drawing; but it is evident that his bow pen was none of the best, as his circles are the least neat parts of the drawings.

Now for Michelangelo: the British Museum is not very rich in the architectural drawings of this master, yet it will probably be better to go through them, as they are more accessible to the student than those in other collections would be. They are, for the most part, sketched on with common ink, which has now turned brown, with a common pen, and drawn right off by hand, the circles being put in anyhow. Some of them may probably have been first of all scratched in with charcoal, but we have no traces of it: one of them, however, has evidently been inked in upon something resembling chalk, or very black soft pencil. The drawings, even the details, are exceedingly rough, and if ever worked from, must have been drawn out on a board by a pupil, and afterwards corrected by the master. They consist of all sorts of subjects, windows, capitals, entablitures, &c., but none of any great interest. The Musée Wicar, at Lille, is the place one must go to who wishes to see what the architectural drawings of Michelangelo are really like. It appears that Wicar got hold of a sketch-book of Michelangelo's, very similar, in fact, to that of Willars de Honecourt, and it is this book, cut up, framed and glazed, which constitutes one of the riches of the Lille Museum. The book contains architectural studies from the modern contemporary edifices—from those of Bramante and Brunelleschi, studies from classic buildings, and his own compositions, including the façade of St. Lawrence, and the plan of the vestibule of the Laurentian Library; and lastly, directions for casting artillery. It is curious to compare this latter with the trebuchet of Willars, so excellently described aud elucidated by Professor Willis. I find the following notes in my copy of the Wicar collection. These drawings are executed in brown ink, with the help of a common straight-edge. There are no cross hatchings, and the plans are tinted, in a very careless manner. Very often no straight-edge is used, and the lines are drawn in by hand. Lines are also often drawn with a blunt point on the paper. The same institution also contains the vellum sketch or pattern book of Francia. As many of these compositions are very small, $\frac{3}{4}$ by 1 inch, and as they have the appearance of having been done for nielli, it is not improbable to suppose that they were intended to serve him in his profession of goldsmith. One page contains ten Madonnas, each less than the other, the largest 1 square inch, and the least, $\frac{3}{4}$ of an inch by $\frac{5}{8}$. There are also on the same page twenty-four portraits, eight of whom are Turks, besides several other subjects, such as children's games, &c.

This museum also contains a drawing attributed to Van Eyk, of which there are duplicates, if I remember rightly, at Bruges, Cologne, and I think Antwerp. It represents a female, seated in front of a tower, holding a palm-branch and book; the tower is octagonal or hexagonal, and in process of being built: it is drawn on paper and entirely by the pen, except in some dark parts, where a little colour is dragged on to assist the lines; there is no cross-hatching, but occasionally small dots are used to continue the lines; it is covered with squares, and I suspect it to be a copy.

We must now return to England. By the great kindness of Mr. S. Smirke, who put himself very much out of the way to oblige me, I have been enabled to examine the drawings by J. Thorpe,

preserved in the Soane Museum. As several of these drawings are already known by the *facsimiles* published by Mr. Richardson in his series of Elizabethan architecture, it will not be necessary to enter into the subjects represented, and I shall only say a word or two upon the execution.

Thorpe appears to have had all the advantages which we have in the present day, except that he could not rub out his pencil, or leaden point. The centre lines are therefore done with a blunt point. His plans are seldom etched, although there are one or two so treated; among them, a very curious plan of Henry VII.'s chapel, showing all the screens perfect, as well as the site of Edward VI.'s tomb in front of that of Henry VII., which tomb was put up by one of his sisters and destroyed by the other. It is curious that I did not observe any cast shadows in the tinted elevations of Thorpe,* or, of any of those which I have been noticing; it being reserved to us moderns to make our drawings at once ugly and scientific. With Thorpe we take leave of the middle ages, and I here propose to close this notice, merely calling attention to the valuable and clever volume of drawings in our library, containing a large number of sketches washed in in sepia and Indian ink, apparently designs for scenes. Although belonging to the most Rococo period, they display a power of invention and design which would do honour to any age; and we can only regret that such good men should have fallen on evil times. We also possess a little sketch by Sir C. Wren, done like those of Michelangelo, with the free hand, with common pen and ink. At the end of the last century, and the beginning of the present, the fashion was to make drawings in fine lines, tinted with Indian ink.

At the revival of Mediæval art a favourite way of sketching was to outline in pencil, and tint up with Indian ink or sepia. Most of Mr. Blore's drawings are done in this manner, and are so surprisingly and minutely finished, that they give the idea of very clear photography. But before this the custom of offices was to make the drawings simply in thin lines, and then to back-line them —a practice destructive of all breadth of effect, and absolutely perplexing to the eyes.

The elder Pugin's works are specimens of this style, which, I am happy to say, is nearly obsolete.

The younger Pugin brought the first change to the system in his plates where he made things look too well by his marvellous etching; indeed, there is a fizziness and an action in all his plates which you look in vain for in the real thing. The present system of etching up a drawing is an offshoot from this style, and is, I am afraid, open to nearly the same objection.

We have, for its use, to thank competition committees, who, forbidding the employment of colour, have obtained a much more seductive style of perspective; for I think I would any day back a good etched drawing against a coloured one.

But, of course, the success of a design in stone and mortar must depend upon the working drawings, for nobody sets out work or chisels stones from perspectives; and it is in these that I hope to see good, strong, thick, bold lines employed, so that we may get into the habit of leaving out those prettinesses, which only cost money and spoil our designs. But, after all, no amount of architectural drawing would make a man an artist or an architect,—for they are one and the same thing,—unless he obtains a complete mastery of the human figure; and I would earnestly suggest whether this Institute could not aid the attainment of this end by having evenings when a model should sit and a good artist be engaged to correct the drawings. When the profession generally begin to draw the figure and make bold architectural drawings, and generally to think for themselves, instead of going to past ages and precedents, we may then hope to have an *Architecture*.

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* When I say cast shadows, I mean cast shadows sharply defined. There is often a cast shadow, but it is almost always shaded off.

Professor Donaldson, V.P., said that the meeting must feel much indebted to Mr. Burges for the instructive and amusing manner in which he had treated a subject which he himself hardly thought would have afforded so much interest. Amongst the points which had occurred to him as arising from the paper, he might refer to Mr. Burges's interpretation of the spiral staircase on the St. Gall plan. He did not think that any such staircase could have been constructed otherwise than in steps, and that the drawing referred to as showing an incline, was merely a conventional manner of representing steps.

Mr. Burges said that the ascent to the Campanile at Venice, and to the great staircases at Amboise, were by means of an incline. The St. Gall staircases were 20 to 30 feet diameter.

Professor Donaldson said that it would be impracticable to construct small ones without steps. Mr. Burges had suggested that Harold obtained the designs for his churches from Flemish architects, but he (Professor Donaldson) wished that he had vindicated the English architects, and shewn that we had men who could design, as well as execute, our buildings.

Mr. Burges said it was almost generally acknowledged that Edward the Confessor sent to Normandy for his architects; and that they introduced a particular style, and that there was nothing else like it remaining. His own opinion was the same as that of Mr. Freeman, viz. that England had a national style at that early period, but unfortunately the greater churches were all destroyed, and the smaller parish churches alone remained.

Professor Donaldson said that in the year 1853 he had drawn the attention of the Institute to the drawings at Lille, collected by M. Wicar, and he had then expressed his opinion, that the drawings in that collection, ascribed to Michael Angelo, were in fact the work of Vasari.

Mr. Burges said that M. Benvignac had mentioned to him Professor Donaldson's opinion, and expressed his own to the contrary effect; grounding it upon the fact that, in the little figures particularly, the hands were executed with great vigour, indeed almost anatomically, whereas in the drawings by Vasari they were put in very carelessly.

Professor Donaldson nevertheless considered that Vasari was a very careful draughtsman.

Mr. M. Digby Wyatt, V.P., concurred with Professor Donaldson. He could not believe that the drawings in question were the work of Michael Angelo, after comparing them with his other known productions. They were wanting in minuteness and studied attention to the *end*, which was always found in the works of that master. The lines appeared on the contrary to get weak at the end.

Professor Donaldson referred to the large collections of architectural drawings preserved in the libraries of some of the Princes of Italy, and particularly at Rome. He had intended to publish a volume of engravings from these drawings, with autographs, and especially the drawings connected with St. Peter's, of which he made fac-similes. The Italian architects of the thirteenth and fourteenth centuries drew one side of an order in geometrical elevation, and another in perspective, as it would be seen from an oblique point of view. They were executed in sepia, and more or less shaded; the ornamental parts being treated with great power and freedom. In the Duke of Devonshire's Collection at Chiswick, there were some interesting drawings by Palladio and other Italian architects, a list of which had been published by the Institute, and an examination of them, by permission from his Grace, would well repay the time and trouble of a journey to Chiswick.

Mr. M. Digby Wyatt regretted that Mr. Burges had not alluded to one of the most eminent of all draughtsmen. In the print-room of the British Museum ample proof might be found of the extraordinary energy and refinement with which Hans Holbein treated the delineation of architectural ornament. With regard to the thickness of line which Mr. Burges appeared to consider a great desideratum, Mr. Wyatt was not prepared to give to such a practice any unqualified adhesion. So far

as Mediæval usage went, it would appear that the practice of drawing in a thin line originated with the Anglo-Saxon illuminators, who, being unable to handle the brush as the ancients did, imitated in thin pen lines the body-colour work of the classic illuminations. This they appeared to have done by sketching on the vellum with a leaden point, and then inking over their sketches. In the celebrated Harleian Psalter the exact practice might be recognized, as in some instances the lead lines were left uninked. When Saxon illuminations were afterwards imitated in France, the thin pen line was introduced into that country. During the eleventh and twelfth centuries the ink lines were thickened on their inner edges so as to give sharp bounding forms, and to heighten expression without reference to light or shade, much as would be now done by a person making a drawing for stained glass. That remained the prominent characteristic during the first half of the thirteenth century, when it became merged in a more brilliantly-painted style, one in which the brush superseded the pen. In the Italian drawings of Giotto, Masaccio, &c., in many of which architecture was freely introduced, the leaden point was generally used, and fineness rather than vigour of outline was aimed at. In the School of Padua outline was profoundly studied, and the cartoon of Mantegna's at Hampton Court, proved his masterly hand. Bramante's style was pretty rather than brilliant, though he executed some paintings on a larger scale; Leonardo da Vinci had left many most beautiful specimens, more or less architectural, and he excelled both in the firm line and bold touch with the strong reed pen, and in the extremely-refined style with the "pennellino" as well as with the leaden and silver points. Nor for varied excellence in architectural drawing should such men as Raffaelle, Giulio Romano, Baldassare Peruzzi, and Giovanni da Udine, have been omitted in any dissertation on the subject. The practice of the great masters of Italian architecture was well shown by the competition drawings still preserved in the Sacristy of San Petronio, at Bologna. As British architects, they could congratulate themselves on that remarkable English artist, Inigo Jones, who was a great master of the pencil. His excellence as a draughtsman in landscape and figures was shewn in his sketch books (more particularly in his studies for the scenery and costume of masks and pageants), and his architectural drawings were admirable. Wren was a good and careful draughtsman, but not artistic. Kent, though an indifferent designer, drew with a most brilliant touch, almost rivalling that of Berain, the "dessinateur des menus plaisirs," &c. to Louis XIVth. The Adams's were remarkable for their ability, and their drawings were exceedingly spirited. After the improvements of Uccello and the age of Bramante, it was the common practice to draw architectural subjects in perspective, and the perspective was far better than it generally had been before their time. In several of Bramante's son-in-law, Raffaelle's, pictures and sketches, the architectural perspective is studied with the greatest care. Many of the XVth century illuminators, especially the Flemish, drew architectural subjects in very fair perspective. This was apparent in the works of the Van Eycks, and more especially in those in which their sister, Margaret Van Eyck, was supposed to have participated. He had seen some unfinished pictures by Van Eyck, which shewed that the outline was first drawn in pencil in the finest possible outline, and the shadow given from the brush with the greatest delicacy. Nothing could be more pure in style than these drawings. To pass from ages gone by to time present, upon the whole Mr. Wyatt thought English artists were rapidly attaining a happy condition of graphic facility, and he could not fail to recognize this increased dexterity as a happy indication of the probability, that ere long we might realize a successful National School of Art,—a consummation to which he sincerely believed this country was rapidly tending.

Mr. Seddon, Fellow, thought the object of Mr. Burges's lecture was to explain the different styles of drawing usually adopted, and to advocate the firmer and more stern style of which he had given a good example. The question was, how that was to be accomplished. The object of an

architect's drawing was to explain his thoughts, and not to hide them as was done by *etching*, which, though it made a very pretty drawing, did not clearly express the design.

Mr. Papworth, Fellow, asked Mr. Penrose if there were any remains now visible of the Saxon Chronicle painted behind the west front of Lincoln Cathedral.

Mr. Penrose, Hon. Sec. F. C., said that he concurred with the late Mr. Edward J. Willson, of Lincoln (whose opinion he should be sorry to question), in believing the Architecture of the west front of Lincoln Cathedral to be Norman, without any admixture of Saxon. He could give no information as to the remains of the Saxon Chronicle.

Mr. Papworth wished for some specimen of what was regarded by Mr. Burges as a moderately thick line. If Mr. Burges was advocating the thick line seen at the present time in some perspective drawings, and rendered thicker by being put upon absorbent paper, it should be settled how many lines were to be omitted for the sake of a thick one in showing on a small scale a suite of mouldings. An architect's 'general drawing,' or 'perspective,' should define what was proposed sufficiently to avoid taxing the employer's invention to supply the details, &c. that would have to be left out in favour of the thick line, at least in such a drawing (say at a quarter of an inch to the foot) as was generally large enough for ordinary purposes. The present system of *hatching* (which is not *etching*) is nothing more than colour put on by thin strokes instead of by a wash. It was not clear whether Mr. Burges wanted the 'good, strong, thick, bold line' for perspectives; and as regarded working drawings he would probably be satisfied with the school in which he (Mr. Papworth) was trained, and by which profiles were marked by a line varying from one to eight-sixteenths of an inch thick, according to the circumstances. In the Print Department at the British Museum was amongst other admirable ones by Holbein, a large drawing for a chimney piece, well drawn and back-shadowed, with the shadows suggested by a tint. It was worth a visit; and perhaps its only fault was that the shadows did not express fully the probable results of the work. The suggestions made by Mr. Burges to black up hollows to a sharp edge for the sake of clearness, not to back-line, and not to shadow in tint truly, would meet with strenuous opposition from him (Mr. Papworth), who would further say that he fully concurred in the denunciation by Mr. Burges of the thin hair line: that line was due to the Continental architects of the seventeenth and eighteenth centuries; they kept refining their line until they could get as fine a line with the etching-needle as with the burin; and the prevalence of such a line during late years in England was very much due to the practice of the engineers civil as well as military. Mr. Burges seemed to have erred in speaking of that thin line as a fault of *English* draughtsmen in the worst days of architecture; for if the architectural drawings in this country matched the specimens of them known to him (Mr. Papworth), they would be found to consist of clear and clean lines down to the time of the elder Pugin: such were even the drawings made in the office of the Adams', except, perhaps, when an Italian had been engaged upon the minute decoration of their designs for ceilings. The abandonment of back-lining, even to plans, would be an evil: a geometric representation was a conventional mode of seeing a building; and the stronger line was, as a portion of that convention, a mode of seeing what portion projected.

Mr. Street, Fellow, thought that such a discussion as the present was likely to bring architects and their work into some disrepute, when they were found quarrelling about the thickness of lines. Every artist who was fit to be called an artist, drew in his own way, and it would be absurd to ask him to draw like anybody else. All they wanted was to express themselves in the most convenient way, and not to crosshatch elevations so that builders should put in dog-teeth without occasion. The books of the elder Pugin might be defended on the ground that he represented the absolute and exact lines of the buildings, whereas if he had instructed

his engravers to use thick lines he would have given illustrations of no value. The question was one of style rather than drawing. He agreed with Mr. Burges that crockets should be given up; but a great many artists would give up the crockets, whether they drew in the broad or in the fine style. It was not to be supposed that all architects should use Indian ink, and for himself he had enough to do to put his drawings in pencil; so long as his work arrived at a right result he did not care what material was used for the drawings, although modern architectural exhibitions would almost lead to the supposition that drawings were to take the place of the buildings themselves.

Mr. M. Digby Wyatt said Mr. Papworth had misunderstood him in supposing that he condemned the use of "cast shadows."

Mr. Penrose, thought the remarks of Mr. Street were excellent as a gloss upon what Mr. Burges had said, but they did not disprove his argument. He could see the advantage of every architect expressing himself in his own way; but still it was very desirable that the best school of drawing should be pointed out to the student, and Mr. Burges had done good service in pointing out the school of Michael Angelo as one of the highest, if not the highest to be followed. The best collection of Michael Angelo's drawings was in the Taylor Museum at Oxford. The drawings preserved at Bologna were exceedingly interesting, those of Palladio being drawn in a thoroughly straightforward practical style, of which the finest lines were "moderately thick,"—which he would define as meaning that eight such lines would go in one-eighth of an inch, speaking, from memory now some years old. The principal elevation by Palladio was upwards of 4 feet long by 2 feet 6 inches high, and the ornament was very correctly expressed. Unfortunately Palladio could not draw the figure, which was the one thing which detracted from his superlative merits as an artist. The most remarkable of the series, as a drawing, was one by Vignola, which was shaded, with cast shadows, &c., the lights heightened with white chalk, and every appliance of that kind employed. He considered the use of very fine lines some time back by English artists had arisen from their following the French engravers. He might refer to the plates in M. Daly's works presented that evening, where the lines were very fine, though not so fine as in some of the French engravings, to many of which it was almost necessary to use a microscope. Honest straightforward drawing was very much to be referred to this thin style. Any person accustomed very much to study out of doors and drawing from real buildings, would necessarily fall into the natural style, in order to convey to himself the building he saw before him; and this kind of practice was far better than filling portfolios with drawings, to study, adapt, or copy from. The effect was shown by the converse proposition; for when an artist who had so studied made a drawing for himself, his lines would mean something to him, and also to those whom he meant to judge of them. If this plan were carried out without reference to producing a fine office drawing, there would be no fear of getting into a bad style, either too thin or too thick.

Mr. Kerr, Fellow, considered that there was a Classical and a Gothic style of drawing, just as there were the two styles of architecture; and that the characteristic of drawing for Gothic architecture was its picturesqueness, and that for Classic architecture its beauty of finish. In the quasi-classical drawings of the last century, the lines were fine and the shadows indicated—the intention being to produce a refined representation. That style was now changed into the romantic or picturesque, as illustrated by the drawings of Mr. Burges himself, and of Mr. Seddon. He agreed that the style of drawing was part of the intellect of the designer, and adopted by everyone as an inevitable necessity. Architectural drawing was, in fact, a language, intended to represent honestly on a flat surface that which was to be executed in the solid, and this should be done by a distinct and plain

drawing with a moderate line, neither too thick nor too thin, but according to the scale of the drawing, and so legible and intelligible as to represent the subject truly. When they proceeded to the question of masterly artistic drawing, and the touch of a firm pencil (which for practical uses was a treacherous thing), the difference between one style and the other became more observable. He agreed with Mr. Burges that a forcible nervous line was to be encouraged, in whatever style of design the student might practice, and such a line might be employed even in the most delicate work.

Mr. Talbot Bury, Fellow, observed that Mr. Street had said all that need be said in defence of the elder Pugin. The mode of putting in back lines prevailed considerably in France, and Pugin being a Frenchman, naturally fell into that error, as he would call it; because, in his opinion, the proper plan was to draw the form in a clear line, without discussing whether it should be the forty-eighth or the sixty-fourth part of an inch; and although a touch here and there to give it picturesqueness might be desirable, that should be done as little as possible. They were all indebted to Mr. Burges for his admirable paper, and he believed that Mr. Street had hit the right nail on the head in saying that every artist should throw into his work the expression belonging to himself as an artist, as it was impossible to lay down any rule on the subject.

Mr. Penrose said that in naming one-sixty-fourth of an inch he was stating a fact, not a sentiment; that being the line adopted by Palladio. Differing from Mr. Kerr, he did not think a different style of treatment was required for Gothic and Classical drawings.

Professor Donaldson said that the intention of a drawing was to represent what would be its appearance when executed, and that, unless a back line were introduced to show the part that was in shadow, the representation would be false, and only resembling the inlaying of a table. The same objection applied to the drawings laid before the students of the schools of art, and he wished the directors of the South Kensington School had been present to hear that opinion. Nothing, indeed, could be more injurious to the students than to study from drawings giving one rigid, hard, metallic line, of uniform thickness throughout, and utterly devoid of sentiment. He therefore differed from Mr. Bury, and contended that all outline drawings should indicate the projecting and receding parts.

Mr. Bury said he had intended to limit his remarks to strictly geometrical drawings.

Mr. Papworth thought that a drawing was a conventional mode of representing a building on paper, and that even in a geometrical elevation, where the architect intended that there should be a deeper recess, the lines should be marked a little stronger to indicate it.

Mr. Street said that his experience of back-lining was, that all the bad architects used back lines to conceal their bad drawing.

The Chairman, Mr. G. Godwin, M.P., in proposing to the meeting the vote of thanks to Mr. Burges, alluded to the careful research which his paper displayed.

The vote of thanks was carried unanimously, and the meeting adjourned.

ON CHURCH AND CONVENTUAL ARRANGEMENT.

Read by the Rev. Mackenzie E. C. Walcott, M.A., F.S.A.; F.R.S.N.A.; Membre de la Société Française d'Archéologie, Membre Corr. de la Société des Antiquaires de Normandie, &c. as elsewhere mentioned.

"C'est à la religion à relever la tête pour l'homme vers Dieu, c'est à l'art à la soutenir. Les Architectes sont, après les pretrês, les co-opérateurs les plus effacaces de la grâce du Seigneur."—Piel de Lisieux, in M. Trebutien's "Caen."

The Upper Chamber of Jerusalem was an ordinary dwelling-room, built, like many of the Norman houses, over store chambers. The first mention of a church occurs in St. Paul's Epistles; the next is of the early part of the third century. The word κυριακον, or church, occurs first in the writings of the succeeding century.* The form adopted was that of an oblong, allegorical of a ship, a symbolism preserved in the name of nave (navis), as the spiritual church was described as "The Ark of Christ;" and the triple arrangement of the lower arcade, triforium, and clerestory, bear an analogy to the first, second, and third stories of the Ark. In the "Apostolical Constitutions" of the fourth century, the direction is given—"Let the church be oblong, turned towards the east, with lateral chambers (παστοφορια) on both sides, toward the east, as it is to resemble a ship; let the bishop's throne be in the midst, with the presbytery sitting on either side, and the deacons standing by."† The church of SS. Vincent and Anastasius, at Rome, built by Honorius I, c. 630, has its wall curved like the ribs of a ship. However, in the poem of S. Gregory Nazianzen, "The Dream of Anastasia," Carm. ix, Op. tom. ii, p. 79, mention is made of "a Christian temple of four parts, with aisles in the form of a cross." At Djemilah, in Egypt, Lenoir states that the foundations of a church, anterior to the time of Constantine, were discovered; it contained a square cella, inclosed by walls; a nave of five bays, with arcades opening on three colonnades, without a porch, but having a door on one side.

At Thebes,‡ Baalbec, Philæ, Sebona, and Maharraka, mentioned by Belzoni, the Christians effected a new internal arrangement of the Pagan temples; a plan not uncommon, as we find in Eusebius, c. 380,§ and in Sozomen.‖ The atrium was roofed in and subdivided, as a nave, into aisles.

Eusebius,¶ describing a church, or basilica, at Tyre, built c. 313—322, by Paulinus, mentions in it a semicircular apse, having sacred inclosures, and forming a Holy of Holies. Stalls for the bishop and clergy ranged behind and around a central altar, with a wooden trellised screen parting it off from the nave, which was a square divided into three alleys; seats for the congregation; a lectern in the centre of the nave, flanked by singers and communicants; side porches, and a large vestibule; upper galleries for women;; and lastly, a square court, surrounded with a trellised colonnade, and having a fountain in the centre. It is not difficult to recognise here the antitype of the Jewish

* Lamprid. Vit. Sev., c. 49; Chron. of Edessa., ap.; Asseman. Bib. Orient. tom. i, p. 57; Tert. de Idol., c. 7; Adv. Val. c. 3; De Cor. Mil., 3; De Pud., c. 4; Cyprian Ep. lv. 33; Greg. Thaum. Ep. Can., c. 11; Greg. Nyss. in Vit. Greg. Thaum.; Dionys. al. Ep. Can., c. 2; Lactant. Inst. Div. l. v., c. 11; De Morte Persec., c. 12, 45; Ambros. in Eph., iv.; Euseb. H. E. l. viii., c. 1, 13; Optat. de Sch. Don., lib. ii, c. 4.

† Ap. Const., l. ii, c. 57. ‡ Lord Lindsay, i. p. 11. § Hist. Eccles., iv. 24. ‖ Hist. Eccles., vii. 15.

¶ Hist. Eccl., x. 4, 21, 43. See also S. Paul, Op. ed. Muratori, c. 203, in col. 912; and Faber's Virgilantius, p. 177

temple, which contained a triple division, the inner sanctuary, preceded by an enormous porch, and subdivided into (1) the worldly sanctuary, (2) the holy of holies, and (3) the outer court of worshippers. From the fourth century a corresponding and uniform division of the Christian churches was made, and the two former appellations frequently were re-applied. A church at Edessa* was thus modelled, c. 202. In the Church of the Apostles, built at Byzantium by Constantine, the rooms of the priests were built along the sides of the colonnade, as in the Temple of Zion, as the baptisteries were also circular, in imitation of Solomon's sea of brass.

A relict of this intentional correspondence may be traced in the entrance on the east in the old churches of Rome, St. John Lateran, St. Cecilia, Quatuor Coronati, St. Peter, St. Clement, and originally in those of St. Paul and St. Laurence, an arrangement that re-appears in the decline of Gothic art at Seville, although another assignable cause is the original ground-plan of the basilica having an entrance on the east.

The Parthenon and Temple of Theseus were exceptions to the rule of orientation observed by the Greeks, and according to Hyginus and Plutarch, by the Romans. Paulinus of Nola, ep. xxxii, ad Severum, mentions that the church there was a similar exception. Sidonius Apollinaris, speaking of the church of Lyons built by Bishop Patient, faced the east; so also did St. Mary's, Antioch,† and that of Tyre, both built by Constantine. Walafrid Strabo says that the principle of orientation was introduced only after a considerable lapse of time. Tertullian (Adv. Valent., c. 2), c. 200, speaks of the church facing the east.

The Byzantine arrangement was of three kinds. 1. The circular, as at Jerusalem, imitated in the round churches of the west. 2. The basilican, with apsidal termination to the transepts, as at Bethlehem, imitated at Noyon, Soissons, and Bonn. 3. The so-called Greek cross, as at St. Sophia, Constantinople, imitated in Provence, owing to commercial relations with Greece and Constantinople; in the west of Aquitaine through the intermediate step of St. Mark's, Venice, owing to Venetian settlers; and on the borders of the Rhine owing to the support given by Charlemagne to Oriental art.

The circular form of the Holy Sepulchre built by the Empress Helena at Jerusalem, rebuilt by Charlemagne in 813, was caused by its erection round a tomb: octagonal churches, such as those of Antioch and Nazianzum, like baptisteries, were built on symbolical designs. The church erected on the Mount of Ascension powerfully affected the Eastern mind, and became a model for similar buildings; the domes of which were inscribed with the grand words of the angelic salutation to the Apostles.‡ The dome was a necessary constructional development as the fittest covering for a round building. Constantine built the first round churches in the west, those of St. Constance, and SS. Peter and Marcellinus at Rome. In the interior of the latter and of St. George, Salonica, built by him, with its seven trigonal chapels; in those of the Holy Sepulchre; and in the eight little apses of the Church of the Apostles, at Athens; and of S. Vitalis, at Ravenna, built by Justinian, we observe a singular resemblance to the chevet with its radiating chapels.

An octagonal church, externally circular, occurs at Hierapolis, of an early date. Circular and polygonal churches are also frequent in Armenia. That of Etchmiasdin is a square, with a central dome and apses to each arm of the internally marked cross.

In the Church of the Apostles at Constantinople, Constantine adopted the form of the Latin cross, as in the church of St. John Studius, and a central dome above the sanctuary;§ the nave had a

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* Note of Michaelis; Rose's "Neander," i. 246. † Socr. Hist. Eccl. lib. v. c. 22. ‡ Acts i. 11.
§ Eusebius; S. Greg. Naz. Somn. Anast. c. ix.; Procop. de Ædif. Just.

timber roof. However, the necessary construction of four pillars to carry the dome, and of vaults to the nave and transepts, led to the abandonment of the flat ceilings and roofs of the Latins.

The circle or polygon was thus combined with the Latin cross; and the Gammada, or Greek cross, arose from the combination of four gammas, the numeral designating the Holy Trinity. Arculphus describes a church of this form at Sichem, in the seventh century. The cupola in time was extravagantly developed, and the aisles reduced to narrow passages in the time of Justinian. S. Sophia, consecrated A.D. 557, of which the Emperor Justinian said, with a burst of emotion, "I have equalled thee, O Solomon!" forms a square with an eastern apse and a central cupola, and the form of the cross is formed internally by two square halls on either side of the dome; a portico ranges along the entire front of the building, as at S. Vitalis, Ravenna. Sometimes doors only mark the form of the cross. Cupolas erected over each of the four arms served the same destination. After the reign of Justinian, the Eastern churches received a better arrangement, a central dome, a nave with aisles (there are five in the Panagia Nicodemi, at Athens), an inner porch, and three apses to the choir, as at Mistra. In the Benedictine Church of Dapnis, near Eleusis, probably built by the Venetians, the ground-plan is a Greek cross, with central and eastern cupolas, an apsidal choir, aisles, and square lateral chambers. The dome at first flattened, as the builders grew bolder was afterwards elevated, after it had received the addition of a supporting arcade, pierced with windows. The latter were round-headed, and sometimes arranged in triplets; and were closed with trellises of stonework. Belfries were of late introduction in the East, by the Maronites, in the thirteenth century,* as the wooden clappers were long retained, and did not appear until the Franks began to exercise ostensible influence. There is one of the Pointed period at Mistra, and a central tower occurs in Tenos. Chapels seldom occur until the fifteenth or sixteenth centuries. After the Turkish invasion, domes fell into desuetude, and the Latin cross was adopted. The central apse formed the sanctuary, with the altar in the chord; that to the north the prothesis, or place of the credence; the southern was the sacristy or diaconicum; the choir was arranged under the dome, and separated from the altar by the iconostasis, a solid screen with† a central door, hung with curtains;‡ the men sat below, the women occupied galleries. The chancel screen, κικλιδες, is first mentioned by Theodoret.§ Sometimes‖ the men were on the south, and the women on the north side. The choir sat on either side of the αμβων,¶ or pulpit, which had a little desk attached to it for the use of the reader. A long, narrow wand-like colonnade (the narthex) before the west front, imitated in the porches of S. Mark's, Venice, of a later period, had three doors,—the central for the clergy, the north for women, and the south for men. It was at once a baptistery, chapter-house, vestry-room, and lych-gate; and was occupied by the catechumens and penitents. It contained a stoup** for washing. It was sometimes provided with an inner narthex. St. Chrysostom and St. Augustine used to preach from the altar-steps.

The cross was not set up in churches until the middle of the fourth century; and towards its close, pictures of saints and martyrs were introduced. The earliest sculpture is that of the Good Shepherd, carved upon a chalice, as mentioned by Tertullian.

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* Fleury, lxxiii. 46.

† S. Chrys. Hom. 3, in Ep. ad Ephes.; Evagr., Hist. Eccles., vi. 21; Paul. Nol. Nat. Felic. iii. 6.

‡ Greg. Naz. Carm. ix.; Evag. Ecc. Hist., iv. 31. § Hist. Eccles., v, 18.

‖ Const. Apost., ii. 57; Cyril Hier. Pro. Catech. 8; S. Aug. de Civ. Dei., ii. 28; S. Chrys. lxxiv.; Hom. in S. Mat.; Bona de Reb. Liturg., quoting Philo.; S. Ambros. de Virg., &c. Origen in S. Matt., tract xxvi. ¶ Conc. Laod. c. 15.

** Tert. de Orat., c. xi.; Euseb. Hist. Eccles. x. 4; Chrys. Hom. in lii. in S. Matt.; Ps. cxl.; Synes. Ep. 121.

I may mention in passing, that the first notice of a formal consecration of a church occurs in the fourth century: that Venantius Fortunatus, makes the earliest mention of the use of glazing when speaking of the cathedral of Paris, and the custom of burials within the church, may be referred to the interval between the seventh and tenth centuries, and was of gradual introduction.* S. Gregory, of Tours, says it was a Frank custom to hang tapestry round the altars of martyrs.

The Byzantine style, which has been called a combination of the Latin basilica and the round chapel of martyrdom, the latter being derived from that of the catacomb, or, more probably, the round church of Jerusalem, exercised a widely-extended influence, seen in the flat cupolas of the Saracen, the apse of the Armenians, and the bulbous domes of Russia. The Catholicon Cathedral at Athens, probably the oldest Greek church remaining, and perhaps anterior to the time of Justinian, is nearly identical in ground-plan with that of St. Basil, Kief, of the close of the tenth century. The cathedral of S. Sophia, in that town, of the eleventh century, consists of seven apsidal aisles, with broad lateral and also apsidal additions. The Russian type was a square ground-plan, a central dome surrounded by four cupolas, three apses, and a narthex, according to Mr. Fergusson, and found in the fifteenth century in the church of the Assumption, Moscow, built by a Bolognese; but the lateral eastern apses are parted off by screens into chapels.† It is also perceptible in the West, in the Byzantine cupolas, introduced primarily owing to the influence of Venetian commerce and colonists; at St. Front de Perigueux, built 984—1047, on the plan of St. Mark's, and presenting a narthex; in the cupolas of Cahors and Angoulême, at the beginning of the twelfth century; at Souillac, Salignac, St. Hilary at Poictiers, and Fontevrault; in the chapter-house of St. Sauveur, Nevers; in the three eastern apses and the porch of Autun, c. 1150; at St. Medard at Soissons, built 1158, in imitation of Santa Sophia; all buildings of the eleventh and twelfth centuries; and up to the twelfth century in the churches of Normandy, Aquitaine, Poitou, and Anjou; while the Basilican and Byzantine forms are united. It is seen in the round churches of St. Constance, built by Constantine at Rome; St. Stephen, of the fifth century, on the Cœlian Mount; St. Martin's, at Tours; St. Benignus, at Dijon, of the seventh or eighth century; at Aix, built by Charlemagne; a church, imitated in the twelfth century, at Ottmarsheim; at St. Germain, Auxerrois; at Perugia, Bergamo, and Bologna, in the tenth and eleventh centuries; at Charroux, in the twelfth century; at Segovia, Montmorillon, Leon, Metz; in England, in the temple churches (that in London was consecrated by Heraclius, Patriarch of Jerusalem); in the foliated octagon of Justinian in St. Vitalis, Ravenna, bearing a marked affinity to S. Sophia, and the earliest Byzantine church in Italy; in the apsidal terminations to the transepts of St. Martin's, Cologne, c. 1035, S. Maria del Capitulo, in the same city, of the twelfth or thirteenth century; at St. Germigny des Pres, built 807, as at Bethlehem, and at Noyon, of the twelfth century; in the ground-plan of St. Tiburtius, at Rome, of the time of Constantine; of St. Cyriac, Ancona, at the close of the tenth century; St. Cæsar, at Arles; SS. Vincent and Anastasius, Rome; at Torcello; and lastly, in the superb cathedral of St. Mark, completed in the eleventh and twelfth centuries, which contains the pulpit and iconostasis of Santa Sophia, as well as a rood-screen.‡

In the East, the clergy-house (*παστοφορια*, Sept. trans. Ezek. xl. 17), libraries, a guest-house and decanica or prisons adjoined the church.§

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* Cap. Theod., A.D. 994, c. 9; Canons, A.D. 960, c. 29.

† See also Proc. R. I. B. A., 1842, p. 93.

‡ Viollet le Duc, i. 135, 171-2, 210, 216; Lenoir, Arch. Mon.

§ Euseb..; S. Aug.; S. Jerome; S. Basil.

These outer buildings were known as Exedrai, and the garth, which succeeded to the Pagan temenos, as the peribolos, tetrastöon and peristöon.*

The Pagan temples in the West, were, from their small size and peculiar arrangements, not readily convertible into churches; the earliest so transformed was, probably, the Pantheon, consecrated as All Saints', in 610; the next, perhaps, St. Urbano Alla Caffarelli, in the suburbs of Rome. The Parthenon of Athens was transformed into St. Mary's.

When the Christians obtained the right of toleration and open celebration of public worship, they took as their model, or rather actually occupied, the basilica, tribunal, exchange, and hall, which, by their form and dimensions, were admirably adapted for the purpose; they retained the name of basilica, understanding it in the sense of the "palace of the great king." The name may be traced back to the Stoa Basileios of the Archon Basileus: the Portia, the first built at Rome, was erected 210 B.C. by Portius Cato. The judgment-hall of Pilate was a basilica, and its gabbatha or pavement the raised tribune. St. Paul, apparently, was a prisoner in the crypt of Herod's basilica. The atrium remains perfect in St. Clement, which, though rebuilt in the ninth century, is a complete specimen of a basilica of the fourth or fifth century; also at St. Laurence Without, St. Agnes, St. Praxedes, and St. Cecilia. In St. Ambrogio, Milan, rebuilt in the twelfth century, is an apsidal basilica, fronted with a large atrium. The apse, with one of the western towers, dates from the tenth century. At Segovia, St. Millan has lateral exterior galleries, a feature common to this part of Spain and Germany, being the peristyle turned inward, in a transitional state to the cloister. Constantine converted the Vatican and Lateran basilicas into churches, and these formed a type for subsequent structures. The plan was the following. In front of the church was a court, atrium, or paradisus, like the court of Gentiles in the Temple; and the prototype of the future cloister, surrounded by a colonnade; entered by a vestibule (prothyrum), and having a fountain (cantharus) in the centre, covered by a cupola, at which the faithful washed their hands before entering the church. This court served as a cemetery, and station of penitents, catechumens, and neophytes. Where the court was wanting they assembled in the narthex, a porch in front of the church, into which the doors opened; on the left side of it was the font.

The basilica itself, distinguished by its altar from the round baptistery, was a parallelogram, forming with its pronaos and alæ a nave, divided into three, or sometimes five, alleys. The central body had sometimes an upper gallery or triforium for women auditors. The aisles on the right hand were allotted to men, those on the left side to women, the tribunes and galleries on the left being given up to widows, and on the right to young women who had undertaken a religious life. In Trajan's five-aisled basilica, 360 feet by 180 feet, and 125 feet high, there was a gallery of this description. In the centre of the platform of the apse the prætor or quæstor had sat, and on either side, upon a hemicycle of steps (which on the ground plan is subdivided like the radiating chapels of a gothic minster), had been ranged his assessors. In the chord of the apse had been the altar of libations. In the three-aisled basilica of Maxentius, built three centuries later, we find a lateral apse, resembling that of Germigny de Prés. The chalcidicæ, the transverse aisle, occupied by the advocates, became the transept, as at St. Paul's, c. 386; and Sta. Maria Maggiore, c. 432; and the five-aisled basilica of St. Peter, c. 330, where in the latter case it extends beyond the line of nave, to connect it with two circular tombs on the north side, which, possibly covered the apostle's place of martyrdom, and may have suggested the round tomb-houses of a later period. At St. Apollinaris,

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* Euseb. Hist. Eccl., x. 4.

Ravenna, c. 493—525, the transept is wholly wanting, but a rectilinear compartment, inserted in the front of the great apse, offers the first approach to a modern chancel. At Pisa, towards the close of the eleventh century, we find the transept thus developed, with an apse extended into a choir. The triforium gallery under the aisle roofs is found at St. Laurence's, c. 580, and St. Agnes', c. 625; and IV. Santi Coronati, c. 625. But the system never came into general use, owing to the preference for a long entablature covered with pictures or mosaics. At Conques and Fontifroide galleries were constructed in the nave aisles. In the early German churches near Bonn, a männer-chor—a gallery for young men—is found in the triforium.—(Whewell, Germ. Arch., p. 91.) At Parenzo, c. 542, and at Autun, c. 1150, there are three, and at Torcello, five, of the beginning of the eleventh century, eastern apses; at St. Miniato, begun 1013, there is but one. At Romain Motier, c. 753, the plan included a stunted transept, three apses, a narthex of the tenth century, and a west porch like a small galilee of the eleventh or twelfth century. Ara Cœli, at Rome, had a cruciform shape. Pergamus church, c. fourth century, was an aisleless basilica, with galleries, eastern apse, transept, and two round buildings, one on each side of the transept, serving for a tomb-house, a sacristy, or a baptistery. The same principle may have induced the construction of apsidal ends to the transepts. The Roman basilica of St. Peter, built by Bishop Agritius in 328, forms the central part of the cathedral of Treves; it is the only remaining example on this side of the Alps. Schmidt has shown that it was a square, divided into three alleys, and with a central apse on the east. It probably had a portico with five doors on the west.

The gradual development appears to have been the following:—First, to remove the inner narthex and the women's gallery, seating the congregation on one plane; and to build apses to the aisles, as at St. Saba, Rome; St. Cecilia, St. John and St. Paul, St. Peter's-ad-Vincula, and at Torcello. Secondly, to build in front of the Sanctuary (as at St. Paul's, Rome), a wall parallel to the principal front, which was the origin of the transept. Thirdly, to develop the apse by prefixing to it a parallelogram, as at St. Apollinaris, Ravenna. Fourthly, the construction of a triforium, like the upper colonnade of the earlier basilicas, with an external wall passage or arcade forming a communication between the transepts and choir, as at St. Sophia, at Padua. The font, in Italy, was transferred to the nave in the eleventh or twelfth century from the baptistery, but at an earlier date in Rome.

The dais of the apse was railed off by cancelli for a presbytery or bema, where the bishop occupied the quæstor's chair (cathedra), remaining at Parenzo, St. Clement's (of the ninth century), St. Agnes, SS. Nereus and Achilles, Rome; and the priests the seats of his assessors (exedrai).* A choir was added constructionally, which reached into the nave, from which it was separated by a marble balustrade (septum) for the choristers, acolytes, &c. Ambones, or pulpits, were erected on either side of the chancel arch or door; one (analagion), for reading the Epistle; the other (ambo), for reciting the Gospel, serving also as a pulpit, with the paschal candlestick placed on a stand beside it, reproduced in French cathedrals, as at Paris and St. Denis, at the top of the sanctuary stair. A triumphal arch (porta sancta, or regia), formed the entrance to the sanctuary, which contained the altar covered by a *ciborium*,—a *cibo sacro*, from the reservation of the Host, or from the shape of its cupola resembling the Egyptian bean,—a pavilion raised on columns, and standing above the crypt or confession. The theory was that every church (as St. Agnes, St. Laurence, St. Martin, and St. Praxedes) was erected over an actual catacomb; where this was impracticable a crypt was made, and the ciborium or tabernacle was an imitation of the sepulchral recess of the catacomb. There were

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* *Vide* Gally Knight, *passim.*

two tables of proposition, one for the elements, and one for the vessels used in the office: one remains at St. Clement; two at SS. Nereus and Achilles, Rome, c. 800. Where there were secondary or eastern aisle-apses (*postoforia*), that on the left (*diaconicum minus*) served as the sacristy, library, and muniment-room; that on the right (*prothesis*) as the vestry and credence-chamber.

St. Peter's, at Rome, had two aisles on each side of the nave; a transept on a level with the nave; and an apse on the west side, with a floor raised to a height of five feet, forming the platform of the presbytery, which extended about nine feet into the transept. The entrance was at the east end. At the extreme west point was the pontifical chair, raised on a platform above the level of the presbytery; on the right and left of the chair the walls of the apse were lined with the seats of the cardinals. At the edge of the platform stood the high altar, under a ciborium or canopy: it was raised by steps above the level of the presbytery. On each side a flight of five steps led down into the transept. Beneath this platform was a semi-circular crypt, close to the walls of the apse, used as a burial place of the Popes. The entrances were at the junction of the choir and transept. In front of the high altar was the entrance to the confessio, the subterranean chapel of St. Peter, containing an altar. In front of the steps were twelve columns of marble, in two rows, said to have been brought from Greece or Solomon's temple; and, being enclosed with marble walls breast high, and lattices of metal-work, formed the vestibule of the confessionary. At the beginning of the thirteenth century the stairs to the confessionary were removed, and the entrance blocked up. The nave was divided from the transept by the triumphal arch, under which a beam was fixed, and in the space between, a cross—an arrangement corresponding with the rood-beam on the south side; and nearly under the arch was the ambo, from which the Gospel was read. The choir of the canons was a wooden structure in the nave (Willis, Canterb. Cath.).

In the churches of Bethlehem, St. John Studius, Constantinople, in Asia Minor, and Syria, we find the basilican form.

At Athens there is a very ancient church in ruins, apsidal, and with three lateral distinct naves (those on the sides being designed, probably, for women), an area, and central fountain.

In Asia Minor the Byzantine style exhibits one class of domed buildings resembling St. Sophia, and a second like a modification of a basilica, as at Pitzounda (probably built by Justinian), St. Clement Ancyra (slightly later), and Hierapolis. In the former the circular buildings, found detached at Pergamus and Trabala, are incorporated, forming eastern lateral apses.

The sepulchral cell of the catacomb formed the model of the memoriæ, or funeral chapels; the tomb of the dead was the first altar, the catacomb the earliest church at Rome.*

"I was accustomed," says St. Jerome, "to visit the sepulchres of the apostles and martyrs, and often to go down into the crypt dug into the heart of the earth, where the walls on either side are lined with the dead." These catacombs were quarries for furnishing the volcanic sand which forms the subsoil of Rome, and was well adapted to form long galleries; and, it is of interest to remember that a common punishment of the Christian was to work as a sand-digger. One of our Homilies (Peril of Idolatry, p. iii.), says,—"Vaults are yet builded under great churches to put us in remembrance of the old state of the primitive church before Constantine."

Wherever a space intervened in the passages closed by a blank wall, lateral recesses were hollowed out for the reception of sarcophagi; the roof was curved like a dome, and the upper part of the tomb was the altar, as in the early church of St. Sebastian. The crypt was known as the martyrdom or confession. It had three arrangements:—First, when a church was built over a

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* *Vide* Ciampini, 1693; Fontana, 1694; Bunsen; D'Agincourt, &c.

catacomb, the old entrance was preserved, as in San Lorenzo and San Sebastian, with steps to descend into it. Secondly, if the tomb was on the ground, then a crypt was built round it, and steps were made, while the sarcophagus was replaced by an altar-tomb. Thirdly, when a martyr was translated, then the crypt was made to harmonize with the church. In the church of Santa Sabina, the large stair is in front of the altar, at St. Paul's behind it; at St. Saba's, the stairs are in the nave aisles, and the crypt, forming a narrow passage, is reached by corridors, reminding us of the crypt at Ripon. At the Quatuor Coronati, a round stair leads down into it from the benches of the presbytery, as at Torcello, where there is a double wall in the apse. St. Mark's and St. Praxedes', Rome, have narrow galleries like the passages of the catacombs leading to it: there is a subterranean church at St. Martin des Monts and St. Mary in Cosmedin, c. 790. At Inkermann there is a rock-cut church, apsidal, with square-ended aisles.

Rock hermitages occur at St. Aubin (near St. Germigny de la Rivière), St. Antoine de Calumies (E. Pyrenees), St. Baume (Bouches du Rhône), Monserrat, Warkworth, and the Roche Rocks, Cornwall; and in the grotto of Fontgambaud, near Blanc.

In some instances a martyrdom was built like a little crypt, under the altar, with a shrine fenced off by a screen, or perforated marble, as at St. George's, Velabro, and SS. Nereus and Achilles. Sometimes a small hole (jugulum) permitted the head of the devotee to be inserted, or the passing of a cloth to touch the relics. Crypts remain under the eastern apses of Spires, Mayence, Besançon, and Strasburg.

The round church was, probably, peculiar to towns either unimportant or of a limited population.* The baptistery of Florence, built by the Lombardic queen Theodolinda, was the old cathedral; and, until the eighth century, the church of St. Laurence, of the time of Justinian, was the cathedral of Milan. An octagonal building to the east of it was, possibly, a chancel. A baptistery stood on the south. The baptistery of St. Agnes, and the tomb of St. Helena, St. Stephano Rotundo, Bologna, of the fifth or sixth century, and the tomb of Theodoric, now St. Maria Rotunda, were circular. Again, we have also octagonal buildings, such as the Lateran baptistery, and mention is made by Eusebius of an octagonal church at Antioch, built by Constantine. The tomb, however, of Galla Placidia, at Ravenna, built before 450, is cruciform. The circular form had been adopted for the mausolea of Augustus, Cecilia Metella, and Adrian, and the temples of Vesta and the Sun. Almost all the German churches of the time of Charlemagne, as at Aix-la-Chapelle, Nimeguen, and Magdeburg, were circular. In England, and frequently in Germany, as in Spain and Italy, a choir was added to the round church. At Bonn, an oblong nave, as in France, was built in conjunction with the circular building.

In the eleventh or twelfth century circular churches began to disappear. In England and Germany the nave was of this form; but in France, the choir, as at St. Benigne's, Dijon, of the seventh or eighth century, and partially reconstructed in the beginning of the eleventh century, St. Martin's, Tours, of the fifteenth century, and Charroux. At Perugia, Bergamo, and Bologna, of the tenth or eleventh century, the nave was round, and the choir oblong and apsidal. The round nave of the Templars' church, at Segovia, c. 1204, has a choir and aisles terminating in apses. Round churches are found in the island of Bornholm.

The public baths of the Romans, in some cases, became converted into baptisteries: the piscina was the ordinary cold bath of a Roman villa. After the conversion of Constantine, distinct buildings of an octagonal shape were built in front of churches, as at Rome, Nocera, Piacenza, Torcello, Novara,

* Hope, i. c. xi.

and Ravenna, a plan perpetuated to the thirteenth century by the Lombard architects; but almost universally, with this exception, were no longer built after the eleventh century, when parish churches were permitted to have a font. The western baptistery became, after a while, merged in the western apse in Germany. In Italy it served still as a baptistery or a tomb-house.

The basilica was a parallellogram, with an internal transept, and apsidal termination at one end, and a porch at the other extremity. The Byzantine church subordinated nave, choir, and transept, as the supports of a central dome; which was the development of a vault, as the vault was of the arch: the ground-plan at first was a round or octagon, became a square, rendered cruciform by the four limbs rising above the angles round the cupola: three semi-circular, latterly polygonal, apses formed the east end.* The Lombardic, which lasted from the seventh to the thirteenth centuries, comprised both these types.† It had a long nave, triforium, a central octagon, and cupola, set on a square base, making an internal dome; an east end terminating in three apses; sometimes an octagon and an oblong were arranged to form a church.

The eastern aspect of the sanctuary and the cupola are its Byzantine features: the Latin cross, the lengthened nave, the apse and crypt, the latter becoming spacious and lofty, are Roman characteristics. Triforia, or galleries, for women, are built along the aisles of the nave and transept; pillars are grouped; and the roof is of stone, vaulted; but the narthex disappears, to be resumed in the eleventh century as a porch. The baptistery and campanile are nearly invariable, but detached adjuncts. The earliest Lombardic church existing is that of St. Michael, at Padua, built 661. Conventual buildings became prominent and numerous, such as the cloisters of Verona, St. John Lateran, Rome, and Subiaco, of the twelfth and thirteenth centuries. At Coblentz, in 836, and at Cologne, the Lombardic style established a home, reaching France in the beginning of the eleventh century, and England in the latter part of the reign of Edward the Confessor.

One of the earliest instances of the Pointed style is St. Andrew, Vercelli, built by an Englishman in the thirteenth century. It has a square east end and two polygonal chapels attached to each transept, like the ordinary type of Cistercian abbeys. The west end is flanked with towers, and there is a central octagonal dome. At Sienna, begun 1243, we have the triple-gabled front, circular window, and three portals of the characteristic Italian type; a square east end, with the central alley having a niche-like apse in the wall, three aisles throughout the church, with eastern square chapels to the transept, and to the south wing a belfry attached, and a central dome. Florence, begun at the extreme close of the thirteenth century, is triapsal, like the early churches of Cologne, and has a central dome. Milan, commenced 1385, has a five-aisled nave, a shallow transept with aisles, and a trigonal apse. The cathedral of Bari, a three-aisled basilica of the twelfth century, has a circular apse flanked by sacristies. A western transept is found, in conjunction with an octagonal tower, in the centre of it, at St. Anthony, Piacenza, c. 1014; and two western towers, like a *quasi* transept, appear with a western cloister, at St. Ambrogio, Milan, rebuilt in the twelfth century.

In the double church of Assisi, finished in 1230, the upper is a Latin cross without chapels; the lower with a nave lined with chantries, and the shrine of St. Francis in the centre of the transept, standing above a crypt. It was the work of a German architect; and a double church occurs at Rheindorf, consecrated in 1151. The design was to accommodate two congregations, as in the two-storied chapels of the castles of the period; and the double church of Pakefield,—two aisles under one roof,—which was used by two distinct parishes. Wisby is a double-storied church, with a choir common to both. The conventual churches of Russia are of two stories.

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* Comp. to Gloss., iii. p. 3. † Hope, i., ch. xxii., xxxi.

The Duomo of Milan, and the church of St. John, at Naples, were built by German architects in the Gothic style, but there to remain, with a few others, as isolated specimens among the structures of the new school of Pisano. The development of Lombardic into Gothic architecture is marked by rapid changes, the crypt and Latin cross remain; but a spire rises over the central lantern, lateral towers flank the west front, the baptistery shrinks into the font, a lofty screen rises before the choir, which is lengthened out, and porches are formed over the entrance doors.

The formation of the western apse, the construction of an eastern aisle, the development of the choir, the formation of the ante-choir, and the double gate at its entrance with the altar of the Saviour, were probably innovations of the northern architects. The next great change was the erection of a central tower upon four pillars, like the Byzantine dome.

Charlemagne constructed the central dome of his churches on eight pillars, introducing a still more important change—isolation, a passage on every side, a method of central junction by means of arches, and an advance to a lofticr method of construction. Four central pillars, a development of this primary idea, are found at St. Martin at Angers, built by the Empress Hermengarde, not long after Germigny, and in all English churches of the period; also at Hitterdaal, a timber building, in Norway, and at St. Savin, Aquitaine, begun 1023. At Germigny the choir occupies this central space, and at Vignory, a square in a similar position, before the tenth century, marked out by pillars. In the church of St. Savin, Aquitaine, begun 1023, we find four central piers, a transept with an eastern apsidal chapel in each wing, and five semicircular chapels ranged round the choir, which is an arrangement never found in the south. To the necessity for strengthening the central supports, we may refer the construction of engaged shafts, as in the church of St. Miniato, at Florence. At Vignory, before the tenth century, there was a square of six pillars, inclosing the choir with a processional path opening upon six chapels.

At Germigny, built 806, there is a central tower; and at St. Alban's it was added c. 1077—1093. In the province of Toulouse, the earlier churches had a single west tower as Limoges, in the eleventh century, and Alby, built in the fourteenth century, had. The larger monastic towers appear to have been built partly for purposes of defence, partly out of emulation with the castle-keeps, the abbeys being equally with the nobles great feudal lords. The belfry story and the spire, however, formed the characteristics of the church tower. The cathedral towers of the eleventh century served also as municipal belfries. M. Viollet le Duc has traced two schools of towers, one of the West and the other of the East, at Perigord;* one introduced probably by the Venetians, the other derived from the banks of the Rhine, which gave place to a national school in the middle of the twelfth century. In the west of France, conical spires appear in the eleventh and twelfth centuries, some being supported on an octagonal belfry, rising from a square tower. Normandy was distinguished by its central square towers.

The addition of towers, which were rare until the eleventh century, exercised a very marked influence upon the ground-plan of churches.† They possibly were suggested by the pillars of the Romans, and originally were designed as landmarks to point out the position of the church, and as an ensign of power, rather than as belfries, as the bells were for several centuries but small, St. Bernard forbade their construction, as they were not for use, but for pomp.

The first tower attached to a church was built by Pope Adrian I., erected 772, in front of St. Peter's at Rome.‡ One of the time of Justinian, a circular building, was attached to St. Apollinaris ad Classem, at Verona; two ancient round towers are found at Verona, one dating from 1047;

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* Viollet le Duc, iii. p. 363. † Hope, i. ch. xxiv. p. 243; Viollet le Duc. iii. 382. ‡ Comp. to Gloss, iii, p. 14.

another, of the same date, remains at Bury, near Beauvais; a third, of a later period, at St. Desert, near Chalons-sur-Saone; while square towers are found in Italy in the eighth and ninth centuries, as at St. Paul's and St. John's, Rome; and one at Porto, near Rome, built 830.

Towers originally built in the close, as at Verona and Toscella; and before the church doors, as at St. Maria Toscanella and St. Laurence, in Italy, however never forming integral parts of the design, were at length attached to the west front of the church, singly as at Lyons, St. Martin at Tours, Poissy, St. Benoit-sur-Loire, Puy, Limoges, St. Savin, and St. Germain des Prés, and at Paris in the thirteenth century. In the south of France, until the middle of the thirteenth century, in Italy and Spain they remained generally isolated.

Two sometimes flanked the west front, as at Jumiéges, and St. George, Bocherville, with a porch in the centre. In German churches they were frequently connected by a gallery. At Gernrode and Worms two round towers flanked the western apse.* Rouen has six towers. At Clugny there were seven, each bearing the name of ecclesia, in imitation of the seven churches. Laon, like Chartres, was designed to have as many. Rheims had six, and a central flêche. Five towers occur at Tournai (Schayes, iii. 11). Round towers are found in East Anglia; and in Ireland, erected between the fifth and thirteenth centuries, tapering upwards, a form employed owing to the peculiar material of each district. There are also round towers at Brechin and Abernethy, and at Tchernigow, near Kieff, c. 1024. The French round towers appear to have come from the north of Italy, as they are found at St. Mary's and St. Vitalis, Ravenna; and reappear in the ninth century at Centula, Charroux, Bury, and Notre Dame, Poictiers. Towers were sometimes used as record chambers, or as courts of justice.†

In Germany (Lenoir, ii. 209), at the end of the tenth or beginning of the eleventh century, a modified basilican form appears, at Gernrode, c. 960; Hildesheim, 1001; Limburg, 1035; Mayence, Worms, and Spires.

The type adopted was a double-apsidal cruciform ground-plan, as in the east of France, at Besançon, Verdun, and originally at Strasburg; west and east transepts, a long nave, a short choir, both of three aisles; small round octagonal towers were multiplied, flanking the apses, or attached to both the west and east fronts in churches not cruciform. Polygonal domes or octagonal lanterns were employed at the west end, and at the intersection of the nave and choir, and galleries were constructed under the eaves of the roofs for the accommodation of women.

At Hildesheim we find a short apsidal choir, with an aisle on three sides, not communicating with the nave; a western transept flanked, like the transept, with octagonal towers, and a west door wanting.

St. Gereon, at Cologne, of the thirteenth century, has a circular nave, and is one of the last examples of a domical building. Cologne has a chevet, with seven chapels, c. 1322, five aisles throughout the church, and a partially developed transept. Friburg has a western steeple, found also at Ulm; a low, ill-developed transept, and octagonal towers flanking the junction of the nave and choir, round which are twelve chapels. Strasburg was intended to have two western towers, and the whole east part is a basilica of the eleventh or twelfth century; the transept is ill-defined. Ratisbon, 1275 to the fifteenth century, has three east apses, and a "subdued transept." St. Stephen's, Vienna, as Prague was designed to have, has two transept towers. At Bamberg there are two apses, west and east, flanked by towers. Naumberg is of similar design. Xanten has two western towers, without an entrance on this side, with a polygonal apse, and four flanking chapels opening in the choir and aisles. At St. Severus, Erfurth, three spires rise in place of a transept over the apse.

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* Viollet le Duc, i. 208.

† Viollet le Duc, i. 259.

St. Cunibert's, Cologne, consecrated 836, was the first instance of the Lombardic style in the Rhenish provinces.*

German architecture resolves itself into three periods.

The pure Romanesque churches have a semicircular domical apse, lower than the choir (as in several churches at Cologne, Mentz, Spires, Worms, Laach, Eberbach); and frequently the aisles have similar terminations; some churches (as St. Mary Capitoline, the Apostles, and St. Martin), have apses to the ends of the transepts, instead of the usual triple eastern apse; and (at Johannisberg, St. Peter's Gelnhausen, and Laach), the east sides of the transept received semicircular apses. The towers are generally near the east end. There is an apsidal outer gallery round the choir at Laach, Eberbach, Worms, Spires, St. Gereon's, St. Martin's, and St. Mary Capitoline, at Cologne. There are usually two pairs of towers and two cupolas or octagonal pyramids. St. Martin's and St. Castor's, at Cologne, are of this period. A portal cloister, as at Laach and St. Mary Capitoline, Cologne, is another distinctive feature. The sides of the towers terminate in pediments, and in these gables Mr. Fergusson has ingeniously discovered the germ of spire-growth.

In the Transitional or Early German style the apse became polygonal, and of equal height to the choir, and the east chapels of the transept have seldom a simple semicircular form, but have sometimes an additional recess (as at Gelnhausen and Sinzig); or another form (as at Limburg), or wholly disappear with the transept (as at Andernach, Boppart, and Bamberg). At Mentz, Worms; St. Sebald's, Nuremburg, and at Bamberg, the eastern apse is round, and the west apse polygonal; at Bonn the ends of the transepts are polygonal, and the choir apse semicirculur. The churches are of three aisles, and often have a polygonal; as at Bonn and Marpurg, or semicircular end to the transept. Generally, where there are double apses, there are west and east transepts, as at Mentz, St. Cunibert's, the Apostles', St. Andrew's, St. Pantaleon's, Cologne; St. Paul's, Worms; and Nuremburg. Two pairs of towers on the east and west occur at Bamberg, Andernach, Bonn, Arnstein, and Limburg. There is a central octagonal tower at Limburg, Gelnhausen, Seligenstadt, Sinzig, Worms, Hermersheim, and Bonn: sometimes there is a central spire between a pair of towers; sometimes two eastern towers (as at Gelnhausen and St. Cunibert's, Cologne); and sometimes west towers, as at Limburg, Bonn, Seligenstadt, Sinzig, Hermershein, and Boppart. A similar group is often found like a transept at the west end, and sometimes a single west tower in the central compartment of this front. The gables of the towers become more acute, and the cornices lighter. Buttresses were used, and porches were added at the west end.—(Whewell, pp. 80, 108, 110.) Chapter-houses are rare in Germany and France, and seldom circular. A baptistery is attached to Meissen. At Worms, also, of the beginning of the twelfth century, there is a west octagonal lantern flanked with round turrets, a central octagon and east end flanked with round turrets. Spires, of the eleventh century, has an octagonal lantern at the intersection, and west square towers to the transepts. Mayence has a western apse composed of three trigonal apses, an octagonal steeple and west turrets, and an east lantern and a round turret. At Laach, c. 1093-1156, we find the ancient parvis before the church with a west cloister, as at San Ambrogio, Milan; a western apse, used as a tomb-house; a square west tower, with a transept, flanked by lofty circular towers; an eastern transept, a central octagonal lantern, flanked by two square turrets; an apsidal choir, and transepts with eastern apses. Lateral porches supplied the place of a western door. The Apostles', at Cologne, has a tall west tower and transept, a central octagon, and two flanking turrets. St. Castor, Coblentz, Andernach, and Arnstein have two groups of towers, but no central lantern. The third period is the complete or Decorated German, which occurs at Altenberg, Cologne, Freiburg, which

* Comp. to Gloss. iii. p. 11; Whewell, Arch. Notes, pp. 46, 78; Petit's Arch., i. p. 82,

has twelve chapels to the choir, and Ratisbon.—(Whewell, p. 113.) At Zurich, the choir, of the eleventh or twelfth century, is square, while the aisles terminate in apses, and two west towers were contemplated. A thirteenth century church at Kaschau, Hungary, attributed to Villars de Honecourt, has a French arrangement of eastern chapels. Buda, of the same period, has three eastern apses and two west towers. Roeskilde, in Denmark, of the twelfth and thirteenth centuries, is a three-aisled apsidal basilica, with a western tower. Trondhjem, Norway, is cruciform, with square east chapels to the transepts, and an octagonal tomb-house at the east end; an aisleless nave and central lantern. Hitterdaal, a wooden church, is surrounded by external galleries. The cathedral of Lubeck has a three-aisled nave with lateral recesses, an unimportant transept, and a chevet, with seven polygonal chapels and cloisters. St. Mary's is three-aisled, has two western towers with no entrance on this side, a low transept, consisting of chapels; and a chevet, with five polygonal chapels. Dantzic is cruciform, with a west tower.

Belgium.—In Belgium the earlier churches had a square east end, and central and western towers: in later times we find, as in Germany, the French chevets: and the arrangement appears also in several Pomeranian churches. The oldest church in Belgium, that of St. Vincent of Soignies, of the tenth century, resembles Zurich: it has a square east end, and had a central and western tower. St. Gertrude, of Nivelles, has also a square east end, a central tower, and west tower flanked with two circular towers, and a double transept. Tournay has a transept, with aspidal ends of the eleventh century; a chevet with five chapels, consecrated 1213; and a central tower, round which four out of the original six lesser towers are grouped. Antwerp has an ill-developed shallow transept, a chevet with five chapels, a seven-aisled nave, and one of the two western towers which formed part of the design. St. Jacques, at Liege, has a circlet of chapels round the choir apse.

Belgian Gothic architecture exhibits—1. Primary Pointed and Transitional, tenth to thirteenth century. The ground plan is a Latin cross; the principal west door is isolated, and in the Transitional period, lateral entrances were made to the nave and choir, but were removed under a single porch, deeply recessed, at the end of the transept in the thirteenth century. Porches at the west end are rare; towers were square: one stood at the west end, or two, as at St. Lambert's, Liége, and St. Sulpice, Leau; or two flanked the junction of the cross and transept, as at St. Bavon's, Ghent. The principal door was on the west, under a porch, at St. Lambert's, Liége, and St. Mary, Dinant; but on the sides of the nave at St. Vincent's, Soignies, and St. Gervais', Maestricht, the west front, where was no door, had a large window, as at St. Vincent's, Soignies; Notre Dame, Louvaine; and where there are no west towers there are round turrets, as at St. Nicholas' and St. Jacques', Ghent; St. Quentin, Tournay; and in this case there is a central tower or octagon, as at St. Jacques', Ghent. In Transitional the choir was small, lower than the nave—as at St. Vincent's, Soignies,—square ended, or with a circular or octagonal apse. In the twelfth and thirteenth centuries it was enlarged. Sometimes it is aisleless, sometimes has a chevet and aisles, sometimes has not continuous aisles, throughout its circuit. The naves have no side chapels: the large triforium is pointed in Primary, and round-headed in Transtional. 2. Secondary-Pointed or Rayonnant, fourteenth to latter part of fifteenth century, is marked by the huge size of the windows above the entrances. The naves have side chapels; Lady-chapels are rare. There are sometimes as many as four doors at the west end, as at St. Gudule's. Recessed porches occur in the fourteenth and fifteenth centuries. Single or double towers flank the west end—square, as at St. Gudule's, or square below and octagonal above, as at Notre Dame, Antwerp, and St. Bavon's, Ghent, but were designed to carry a spire. At the end of the fourteenth and beginning of the fifteenth century they were intricately carved, as at Notre Dame, Antwerp; St. Gertrude, Louvaine; and Mechlin: this was the period of wooden spires, as at St. Gertrude's,

Nivelles, and St. Bavon, Ghent. 3. Third Pointed or Flamboyant, latter part of fifteenth to latter part of sixteenth centuries. Notre Dame, Antwerp, has a fine octagonal cupola,—a solitary instance. Spires became generally spherical or angular domes.—(Weale's "Quarterly Papers;" Schayes, "Hist. de l'Arch. en Belgique.")

Spain.—The Italian apse is a direct copy from the Roman basilica; the Spanish cathedrals present either the French chevet with a circlet of chapels, or an apsidal aisle surrounding the altar, and opening on chapels with an eastern chapel, which, if the east end is square, is the Lady-chapel,—if circular or octagonal, as at Burgos and Batalha, a tomb-house. The transepts are ill-defined. The interior arrangement is mainly that of the old basilica. The stalls of the clergy are ranged along the west end of the choir (which is shut off from the nave by a wall), and ranged westward of the transept, the whole space under the lantern—the cimborio—being railed in and unoccupied. The sanctuary (capilla major) contains only the high altar. It is curious to observe, in passing, that the canons' choir was in the centre of the nave at the Lateran, S. Maria Maggiore, S. Laurence without, and St. Clement; and that the circular font was placed in the north transept at St. Peter's, as the late Baptistery of Canterbury appears to have been built in accordance with that arrangement.

Leon, commenced 1199, terminates in a chevet with five chapels. Burgos, of the thirteenth century, has lateral chapels attached to the nave;* two western towers, a central octagonal lantern, and octagonal eastern chapel, like that of Murcia, Toledo, commenced at the same period, is of five aisles, like Troyes, with an eastern chapel. Seville is a parallelogram, with five aisles and lateral recesses and an eastern chapel.

Portugal.—Batalha (Lenoir, ii. 229), of the fourteenth century, is a three-aisled nave, with a transept, having four eastern apses: to the eastward of the apsidal choir is an octagonal tomb-house, with radiating recesses, and an octagonal tomb-house inscribed in a square.

France.—M. de Caumont divides French Mediæval architecture into (1,) Roman; (2), Ogival Primitif (thirteenth century); (3), Ogival Secondaire (fourteenth century); (4), Ogival Tertiaire, first epoch, 1400-1482; second epoch 1480-1550. In France,† as St. Gregory describes Tours, and Apollinaris Sidonius, Lyons, the early churches in the north, Poitou, Auvergne, and Burgundy, as in the sixth century, preserved a basilican form, an apsidal oblong, with an atrium surrounded on the three sides by a colonnade. In one part of Aquitaine, and on the banks of the Rhine, they were aisleless; in Provence and Toulouse the basilica of Constantine, at Rome, seems to have been taken as a model. Fontevrault, of the twelfth century, has the plan of a basilica without aisles. From Auvergne to Nevers and Toulouse, the aisles and upper gallery of the basilica were preserved in the eleventh century. The double apse was found in the east of France, and on the borders of the Rhine; at Tours, Besançon, and Verdun; and, probably, Strasburg. Poitiers has also shallow niche-like apses to the transepts, and three choir alleys. The baptisteries were circular. The naves were at length subdivided by pillars, as at St. Vincent's and Paris, by St. Germain, and at Clermont, by Namatius, the eighth bishop, in the fifth century; in the latter church an apsis was added, and at St. Vincent's, which was called in consequence St. Cross, a transept. Namatius built Auvergne Cathedral in the form of the cross. In France, in place of the wall of the niche-like Roman apse, the architects constructed a screen of columns, with an external aisle opening into radiating chapels—a chevet. The chevet was deduced, probably, from the junction of the circular tomb-house so frequently found behind the altar with the basilica, by the removal of the intermediate walls. At St. Martin's, at Tours,

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* Fergusson, Handbook of Arch. p. 825.

† Viollet le Duc, Dict. de l'Arch. s. v. Arch. Rel. Cathedrale; Abside, Chœur, Chapelle; Lenoir, i. 221; ii. 91.

the plan was initiated in the twelfth century by omitting half the eastern circle built by Perpetuus, and building the nave from the tangents, and was fully developed at Conques and Toulouse. Laon, like Dol, has a square end, but in the twelfth or beginning of the thirteenth century, we find semi-circular apses to the transepts of Noyon and Soissons, at Tournay, Belgium; and St. Martin's, Cologne. Till the middle of the thirteenth century the churches of the south of France, generally, had neither eastern aisles nor radiating chapels. In Provence, apses were usually polygonal; in the north, circular. M. Viollet le Duc gives some curious instances of a double east apse. The ground-plan is singularly deficient in a due expansion of transepts, which are often wanting, or frequently only indicated internally. Chartres, Beauvais; St. Maurice, Angers; Autun, Poictiers, Carcassone, and Rouen (the latter strikingly resembling the ground-plans of Gloucester and Norwich), are the chief, not to say almost the only, exceptions. Bourges and Bazas are not cruciform, and, like many cathedrals, appear to have been constructed thus in distinction to the abbeys, in order to show that a cathedral was a national monument built by the people. Portals, as at Laon, Chartres, Amiens, Rheims, Sens, Seez, Paris, Coutances, Bourges, and Autun, are very distinctive of French arrangement, and were probably suggested by the large Clugniac porches. Another prominent feature in the thirteenth century is the prevalence of lateral chapel recesses to the aisles, and even when the aisles are double, another distinctive characteristic of the style, built between the buttresses, as at Rheims, Notre Dame, Paris; Troyes and Bourges; and at St. Martin's at Tours, on the south side of the nave, and to the choir only, as at St. Ouen's, Rouen. St. Front's, Perigueux; Angoulême, Alby, Fontevrault, and St. Maurice's, Angers, are aisleless. Eastern apsidal chapels occurred in the choirs of St. Front's, Perigueux; Nevers, Angoulême, St. Savin, Fontevrault; St. Hilary, Poictiers; Clermont-Ferrand, and Issoire. At Clugny, where there was also a choir-transept, there were double eastern apses to the main transept. At St. Benigne, Dijon, and Langres, c. 1160, there were mere niches in lieu of transeptal eastern apses. St. André's, Vienne, has an eastern apse; so has St. Maurice's, Angers; Angouléme has four apsidal chapels attached; Cluny had an eastern apse with five chapels; Rouen has an apse with three chapels. A chevet with five chapels occurs at Rheims, Noyon, Tours, Clermont, Narbonne, Limoges, St. Ouen, Bazas, Troyes, Clugny (now destroyed), Chartes, and St. Martin's, at Tours (Chartres has, however, an additional chapel on the east, connected by a staircase); with three at Fontevrault and Conques, with seven at Beauvais, Bayeux, Amiens, Mans, Coutances, and St. Stephen's, Caen; and with four at Issoire, a fifth of square shape being inserted to the east. Chalons-sur-Maine, Carcassone, and Angers, have an aisleless apsidal choir; Alby is apsidal, with lateral chapels round its entire circuit. St. Front, Perigueux, as Clugny had, has an ante-church and porch. St. Hilary, Poictiers, and Laon, have square east ends; but in the former instance there are three shallow, niche-like apses. At St. Peter's, Toscanella, and at Spires, similar quasi-apses are attached to the transept. At St. Front's, Perigueux, an oblong building, with an apsidal termination, was carried out beyond the choir, like a lady-chapel. At St. Stephen's, Caen, a north-west chapel is attached to the nave.—(Lenoir, i. 275, 355; ii. 24, 95, 121, etc.; Viollet le Duc, i. 4, 232; ii. 423; iii. 226.)

Chapels.—The word chapel has been derived from St. Martin's cappa,* which the kings of France carried out to their wars and deposited in certain tents, called, from the circumstance, "capella." In a chapel of Westminster, Caxton set up his printing-press, a name from this circumstance attached to printers' workshops. The development of chapels requires particular notice. The first churches had but one altar; but in the sixth century, St. Germain built, at St. Vincent's

* Johnson, Canons, ii. 68; Durandus, ii. 10, 8; Gemma Animæ, i. 128; Ducange, li. 103.

Abbey, four, one in each wing of the cross, besides two additional chapels at the west end. Two centuries later, in the abbey of St. Gall, we find seven, four in each of the aisles, and an apsida chapel of St. Peter at the west end of the church, in place of the mediana, or principal gate of the basilica. Chapels were first built for the sepulchre of saints. At St. Germain des Près was an oratory of St. Symphorian, on the south-west of the front, in which St. Germain desired to be buried. On the north-west was the chapel of St. Peter. The cubicula mentioned by St. Paulinus of Nola, were devoted to prayers, reading of holy books, and commemoration of the dead. St. Praxedes, Rome, has two chapels of martyrs, built 817. There is a chapel near the entrance of St. Demetrius Salonica, and another at St. Cecilia Transteverino; one on the south of the choir at Trieste, dedicated to St. Justus and St. Severinus, like the main church, composed of three apsidal alleys. Sens and Langres have a single eastern chapel; Cahors has three, and Angoulême four apsidal eastern chapels. Towards the end of the eleventh century, radiating chapels and an eastern aisle appear in Auvergne and Poitou, and the centre of France, extending in the twelfth century to St. Hilary, Poictiers, Notre Dame, Clermont, Nevers, and Toulouse; but in Normandy not until the beginning of the thirteenth century; but ordinarily the choirs in that province and the Ile de France were simply surrounded with aisles, as at Mantes, Poissy, and Paris. Laon and Chartres were almost destitute of chapels. At Bourges (c. 1230) and Chartres (c. 1220) the radiating chapels are mere apsidal niches; but in the twelfth century became important, as at St. Denis, and St. Martin des Champs. In the twelfth and at the beginning of the thirteenth century, chapels, according to an arrangement peculiar to abbeys, and afterwards imitated in the cathedrals, were enlarged, as at St. Remy, Rheims, and Vezelay, and communicated with each other by a subordinate narrow aisle. There are three radiating eastern chapels at Nevers, four at Clermont-Ferrand, five at St. Savin's, and only one on the east at Langres, c. 1160.

The difficulty of ranging chapels round the apse, as at St. Germigny des Près, led to the alternation or admixture of polygonal or square chapels with those of circular shape, as at Fontenelle; and in the thirteenth and two following centuries to the adoption of polygonal chapels only, as at St. Nicaise's, Rheims. Owing to this grouping of subsidiary apsidal chapels about it, the apse lost its significant name of chevet (capitium). (Ducange s. v. Capitium, ii. 146: Lenoir, ii. 96.) The cemetery of great persons, as at St. Geneviève's at Paris, was on the east side of the apse, and a lamp was often set in the niche, so as to light both this garth and the crypt.

About the eleventh century the altars began to be removed out of the nave into eastern chapels, and the aisles were rendered continuous and enlarged, to afford a free passage round the choir.

In the thirteenth century the lady-chapel, like the radiating chapels of the apse, received a marked development, as at Rheims, Mans, Amiens, and Beauvais, built 1230-70, and at Coutances. The transepts also at length received eastern apsidal chapels, as at Rheims, St. Hilaire le Grand, Clugny, and St. Savin's, as the choir had previously, in order that the altars might be seen on entering the church. To multiply these chapels a second transept was added, as at Salisbury, &c. At Clugny it received north and south apsidal ends, as at Tournay and Noyon, a new arrangement of the eleventh and twelfth centuries. There are double aisles at Clugny and St. Hilary's.

We are able to collect from the "Rationale" of Durandus, Bishop of Mende, who was born in 1220, and died in 1296, a clear description of a church of that period. It was cruciform, lying east and west, sometimes apsidal, and consisted of nave, chancel, and sanctuary, an apse, a crypt; the roof was tiled; the windows were glazed; the chancel was lower than the nave; there were altar-rails; a screen, and occasionally a rood-loft: a sacristy; a water-drain; there were carvings on the walls of carved images, the zodiacal signs, and Scriptural subjects; there was a veil separating the

sanctuary from the choir, to be raised on certain occasions; and in churches "are suspended two eggs of ostriches and other things which cause admiration and which are rarely seen, that by their means the people may be drawn to church and have their minds the more affected." Among the conventual buildings and accessories he mentions a square cloister, chapter-house, refectory, cellar, dormitory, oratory, herb-garden, and well.

In France the naves did not receive their outer chapels (Viollet le Duc, i. 207; ii. 351)—constructed as at King's College, Cambridge, between the buttresses—until after 1240, and the first instance occurs in Paris, where, in the choir, in 1260, the operation was continued. Limoges, Narbonne, and Troyes were designed without them; Laon, Coutances, Rouen, and Sens were modified for their arrangement, 1300-50. They were added at Amiens about the same period; but in the fourteenth century they disappear at St. Ouen's, while the chevet retains five radiating chapels, the easternmost being most prominent. The outer chapels were probably introduced owing to the enclosure of the choirs.

The architecture of Ireland includes—1. Oratories, as in the south-west district of Munster; and bee-hive houses in Connemara, built of masses of rock, and vaulted with stone of a later period. 2. Celtic, small aisleless rectangular buildings, without an apse, usually in groups of seven, like the churches in Asia Minor and on Mount Athos, with a central west door, and occasionally provided with a chancel, as in the Patrick Temple, Galway, and in the early churches at Glendalough. In the fifth century they are of a type anterior to the Roman basilica; and some were built of timber. 3. Romanesque, ninth to twelfth century, with a basilican arrangement; the throne, or a bench-table, being at the east end, and the altar detached, as at St. Saviour's, Glendalough; the roofs are of high pitch, and chambers are frequently constructed under them, or along the walls, for the clergy. The round towers, at once belfries, beacons, treasuries, and places of retreat, are both of this and the earlier period. That of Glendalough is said to be of the seventh century. Cormac's Chapel, Cashel, has transept-towers of the early part of the twelfth century. 4. Anglo-Irish, from the close of the twelfth century. The original plan of a simple oblong, or a nave and chancel, were preserved to the latest period. Bell-turrets were not common till the thirteenth century. St. Doulogh's Church, of that date, is oblong, with a low square central tower, and adjoins an octagonal baptistry. Christchurch and St. Patrick's, Dublin; Gray, Kilmallock, and Cashel, are Pointed; Jerpoint and Dunbrody, Transitional. Newton has Romanesque features. Transepts were added in (5), the Later-Pointed. In the fourteenth and fifteenth centuries the narrow central towers were added. Cashel, Kilkenny, Waterford, Limerick, St. Patrick's, and Christchurch are, and Kildare was, cruciform. Their towers were central, with the exception of St. Patrick's and Limerick, which were on the west. There is no instance of two western towers in Ireland. The cloister of Kilconnel resembles cloisters in Spain and Sicily.—(*Gent. Mag.* N.S. vii. 439: Wakeman, Arch. Hibernica, 1848.)

The architecture of Scotland embraced—1. Churches of wickerwork, which in the fifth century, gave way to stone churches, like that built by French workmen at Whitherne for St. Ninian, and another constructed in the eighth century by monks from Jarrow. 2. Scoto-Irish, from the middle of the sixth to the middle of the eleventh century; it exhibited round towers, bee-hive houses, dome-roofed cells, small churches, often in groups, and, at Iona, priests' chambers over the aisle. 3. Ramanesque Anglo-Scotish, 1124—1165, as at Dunfermline, Kelso, and Leuchars. 4. Lancet, 1165—1286; Kelso and Paisley had naves shorter than the choirs; Dunkeld, Dunblane, Paisley Sweet-heart, and Whitherne had aisleless choirs; Brechin, Dunblane, and Whitherne were not cruciform; Sweet-heart, Elgin, Pluscardine, St. Andrew's, Aberbrothock, Dryburgh, and Melrose had only an east isle to the transept. 5. Decorated, 1286—1370. 6. Flamboyant, 1371—1567. The saddle-

back tower and polygonal apse are continental features; porches form a characteristic, as at Aberdeen, Paisley, and Dunfermline. Holyrood, Aberdeen, and Dunfermline offer the only instances of two western towers. Dunkeld has, as Glasgow had, a north-western tower. The spires are poor. The imperial crown of Edinburgh is almost unique. The transepts are seldom well-developed. Edinburgh has double nave-aisles.—(*Arch. Journal*, xiii. 226.)

English Architecture—The earliest English architecture of which we have any record, historical or material, was neither borrowed from France nor communicated from Germany. The Saxon churches (Poole's Churches, c. iii. p. 22; Lenoir, ii. 180) were divided into four classes (Canute's Laws, A.D. 1017, c. 3). The word "monastery" occurs in Ina's Laws, A.D. 693, § 6. St. Jerome mentions pilgrimages of the early British to Jerusalem. Wearmouth was built by French masons (Monasticon, i. 501). Stone churches are mentioned by Reginald of Durham (Surtus Publ. pp. 282, 284). Florence of Worcester speaks of the magnificence of Alfred's buildings, and Alcuin of York Cathedral; it was, in 627, a square basilica of stone (Ib. Fabric Rolls, p. vii.). Peterborough was built of immense stones, c. 655 (Hugo Can., ap. Leland, i. p. 3). Lastingham was of stone, c. 660 (Bede, Eccl. Hist., iii. c. 23). William of Malmesbury says that stone buildings were rare before the time of Benedict Biscop, c. 663 (lib. i. c. 3). Polished stone is mentioned as employed, c. 674, at Ripon and Hexham. The word "basilica" is used by Eddius, Vit. Wilfridi, c. 17; Matt. Westm. Anno 750; Ordericus Vitalis, ii. p. 25; Will. Malm., fo. 41: Monast., iii. 135. In France it denoted a minster (Ducange, i. 611): in England, a church before consecration (Otho, Const. 1237, c. 1). At Abingdon, the church, like Clermont (Viollet le Duc. i. 209), had a double apse, with twelve chapels and twelve cells for the monks, in the seventh century (Monasticon, i. 512). The dome shown in Anglo-Saxon illuminations (Arch. Jour., vi. 359; i. 24; Jour. Arch. Ass., i. 20; vii. 270; x. 142) links the style with Byzantine. In the instance of Bishop Wearmouth, c. 675, we are informed that the church there was built after the Roman manner. We shall not pause to consider the stud buildings, like that of Glastonbury, but merely allude in passing to the timber church still existing at Greenstead (Jour. Arch. Ass., v. 1. vi. 191): Bury St. Edmund's, till 1032, was mainly of wood (Monasticon iii. 101). There was a stud Lady-chapel at Tykford (Ib. v. 206). Bede mentions St. Alban's memorial chapel at Verulam, c. 300, as being "of admirable workmanship," and the erection of a stone church at Galloway in 448 gave the name of Whitherne, or Stonehouse, to the place. William of Malmesbury says that St. Aldhem's "broad church survived whole to that day." St. Piran's Church, in Cornwall, of the fifth century, resembled the Patrick Temple of Galway. The nave door on the south was round-headed, with a chevron moulding, a key-stone carved into a tiger's head, and two human heads upon the capitals. The font was octagonal. A single north-east side window, near the priest's door, lighted the east wall of the square-ended chancel; to the south-east was the altar, inscribed with a cross and the name of St. Pirian. The stone chancel screen had an opening on the north side. A bench table, commencing on the south side of his screen, was continued round the nave to the east wall. At St. Gwythian's the nave had a south door, a chancel with a stone screen and altar, and a bench table against the north and south wall returned along the screen. St. Madderne's is a simple parallelogram, with a stone bench and division between the nave and chancel, a stone altar, and in the south-west angle a holy well (Arch. Jour., ii. 225; Jour. Ass. Soc., ii. 68). A similar well was found at Kirk Newton, in Durham.

King Edwin built a stone church at York (Com. to Gloss. iii. 11). St. Augustine introduced the basilican form into England, but without the atrium or narthex. Norwich (Jour. Arch. Ass., xiv.) still retains evidences of a Roman type, where the steps of the bishop's throne appear in the wall behind the altar; at Canterbury the throne once occupied the site of the present altar, while the

altar formerly stood on the lower platform; at Exeter the eagle,* until recently, stood in front of the altar steps, being a vestige of the old custom of reading or preaching from that place.

In the history of Ramsey Abbey (Comp. to Gloss. iii. 18) of the time of Henry I., a church contemporaneous with those of St. Dunstan and St. Oswald, is described as having "two towers, one at the west end, the other central, according to the custom of the period." St. Bennet, Hulme, Belvoir, Wymondham, Durham, and Malmesbury, had two similar towers.—(Monasticon, i. 256; iii. 31, 288; Comp. to Gloss. iii. 21.) The western tower was eminently fitted for the defence of the most exposed portions of the church when it was in danger of assault during unsettled times.—(Lenoir, ii. 379; Viollet le Duc. iii. 340.)

Pope Sabinianus directed the employment of bells in 604. Baronius refers their use to the time of Constantine. Bells came from Italy: the large were called *campanæ*, the small *nolæ*.—(Wal. Strabo., c. 4, 5; Am. Fort., c. i.; Fleury, xlviii. 42; Viollet le Duc, iii. 280.) In Scotland, at Aberdeen and Glasgow, the bells were hung upon trees. Bells are mentioned in England by Bede, c. 680 (Hist. Eccles. iv. 23). Turketul, who died 975, gave a bell named Guthlac to Crowland Abbey, and Ingulphus mentions a peal of seven bells there. By the laws of Athelstan the existence of a bell-tower gave the owner the right of a seat in the town gate, a place on the grand jury. Belfries are distinctly mentioned by a monk of St. Gall in the eighth century. One of the earliest bells remaining is that of Moissac, dated 1273. At Chartres (Dr. Billon, S. F. A., sur les Cloches, 1858) some of the bells bore the name of Les Commandes, as they gave notice for ringing the great bells. The same usage was adopted at Bayeux, where similar bells were called Moneaux—warners. At Clugny the bells were named after their destination—Prayers, Angelus, Retreat, Tocsin, &c. That at Strasbourg, used for the assembly of the Council, was called Magistrat; and one at Angers, Evigilans Stultum, *i. e.* "Waking the fool."

William of Malmesbury describes a church built by Alfred the Great, evidently showing the Rhenish type, as erected in a new way of building; four piers supported the whole structure, which had four round apses in its circumference. Eddius (Comp. to Gloss. iii. 8, 9), Precentor of Northumbria, describes Hexham, built by St. Wilfrid, as "a structure of many parts, long and high, supported on various columns, and above many subterranean chapels;" and Prior Richard, in 1180, speaks of "its nave surrounded with lateral chapels, its walls divided into three stories, its columns of stone, its crypts and oratories, with passages leading to them, and the coved vault of its sanctuary." He also mentions "porticos (or apses) at Ripon."† Alcuin describes Egbert's cathedral at York as "having many apses and curved roofs." At Winchester, St. Wolstan's Church had north and south aisles, an eastern apse over a crypt used as the burial place of bishops, several chapels, and a cloister to the west; and Elphege, in the tenth century, added a west tower. We therefore gather from these facts that the larger Saxon churches were of stone, with a central tower, aisles, triforia, clerestory, apse, and crypts, although inferior in size and ornament to the Norman period. Bede (H. E. ii. 4) mentions a stone altar set up by St. Paulinus in 627, and similar altars are mentioned by the Council of Epaune, 517, c. 26; Prudentius of Spain, in the fourth century; and Sidonius Apollinaris of France, in the fifth century; and the Excerpts of Egbert, in 750.—(Hierur. Angl. 40; Camb. Camd. Soc. 1845; Canons, 714, c. 41; 816, c. 2.)

The church of St. Martin, at Dover, like St. Généroux, terminated in three equal eastern apses. While we recognise the historical fact that the cruciform shape of churches was one of gradual

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* Durandus, iv. ci xxiv. The eagle of St. John was often carved on the pulpit (Lenoir, ii. 136.)

† Comp. to Gloss. iii. 19; Willis in Proc. Arch. Inst. 1845, 10—14.

development, we must at least confess it would be difficult to assign any other reason than symbolical consideration as that which influenced our forefathers in laying out the ground-plan of their churches: and he would not be envied who should attempt to impugn their attempt to embody holy doctrines in external objects, and make the material fabric suggestive of Christian verities. As M. Martin (Hist. de France, iv. 337) observes, "Cet art n'est tout entier qu'une immense aspiration vers Dieu, vers l'infini aspiration ardente et douloureux du cœur." In the tabernacle and temple the form of the edifice, the arrangement of its parts, and the order of its altars and furniture were made by Divine appointment according to a pattern. This model (Milman's Latin Christ. x. 29) in its main features was adopted and adhered to, as far as the different characters of the two dispensations would allow, in the adaptation of heathen buildings and in the positive construction of Christian churches. The doctrine of symbolism, however, must not be pressed too far. The principle of derivation of orientation is very questionable (Proc. Bedf. Arch. Ass. 1856), as far as it turns on the opinion that our Saviour died with his face to the south, or on the direction of the choir to that part of the sky in which the sun rose on the day of Dedication of the Church. The old English Homily on Wake-days (Poole's Churches, iv. 31; Orientator; Symb. of Churches, lxxxviii., lxi.; Churton Eng. Ch. vi. 128), Isidore (Orig. xv. 4), the Gemma Animæ (i. 129), Durandus (v. ii. 27; i. 8), and Walafrid Strabo, mention simply the reason that Christians always prayed towards the east. Viollet le Duc (iii. 235) shows that the declination depended on mere constructional causes. St. Michael's, Coventry, Tynemouth, Bosham, Lichfield, and York bent to the south, and St. Mary's, York, and St. Ouen's, to the north.

At Canterbury the Saxon cathedral was arranged in a great degree in imitation of St. Peter's Church, at Rome. In the very ancient church of St. Gall, c. 820 (Lenoir, i. 32; Viollet le Duc, i. 243; Arch. Jour. v. 85), attributed by Mabillon to Eginhard, the architect of Charlemagne, the ground-plan embraced a long nave with screened chapels in the aisles, a transept with an altar in each wing, a short constructional chancel ending in an apse. A screen ran across the first bay westward by the cross, with lateral doors and in front of the ambo. (At Clairvaux the second or outer choir was used by the sick monks.) The ritual choir occupied the space of the lantern, and was furnished with seats for the singers; a western screen ran in front, and had a central entrance flanked by the analogia, one on each side,—an arrangement which reappears centuries later in the double screen to which I shall presently allude, and in the altars attached to the choir screen in Gothic churches. The high altar stood at the top of a flight of steps, on each side of which were smaller altars, and a lesser altar was placed in the apse. In the centre of the nave was the altar of the Holy cross (Lenoir, ii. 17; Monasticon, iii. 80); probably the first instalment of the future rood-screen. The confession, or cell of the saint, lay under the high altar. In each of the western towers was a chapel. The processional path lay between the arcade of the nave and its lateral chapels in the aisles. The doors in the north aisle, led to the porter's room; in the south aisle, to the poor man's hospice; in the south transept, to the cloister, crypt, sacristy, and dormitory; in the north wing, to the crypt, library, scriptorium, abbot's lodge, and guest-house. Canterbury (Willis Cant. Cath., ch. ii.) was a long parallelogram, divided by two arcades into three alleys. At the west end was an apse with the bishop's throne, fronting the lady-chapel altar. Many abbeys were dedicated to St. Peter and St. Paul; the eastern apse was allotted to the altar of the latter in reference to the scene of his labours, and the western to the former, in allusion to the pontifical throne (Lenoir, ii. 7). On each side of the nave was a tower, forming a quasi-transept: that on the north was occupied as the Novices' School, that on the south was entered by a porch, and contained an altar. The choir of the canons was inclosed by a screen breast high; at the upper end was an altar with lateral doors

in the screen, which closed it on the north and south. In front of the apse, in the chord of which was the altar of the daily mass, were flights of steps on the north, south, and west, ascending the altar platform, below which was a crypt containing an altar, and extending under the presbytery. Against the east wall of the apse stood the high altar. A passage from the south aisle led into the octagonal baptistery, or the church of St. John the Baptist.

Edward the Confessor (G. G. Scott, Trans. R.I.B.A., 1860), after "a new kind of building," changed the ordinary Saxon parallelogram into a Latin cross with a lantern at the intersection; the great area of the church had a lofty vaulting; the end had double arches on either side; the choir stood in the cross below the tower; and above and below were little chapels furnished with altars. St. Mary's in the Castle, Dover, built in the early part of the same reign, the latest date assignable, is cruciform and aisleless, with a central tower. St. Edmund's, Bury, completed 1095, had, besides a central tower, two octagonal west towers; the east end was apsidal, the transept had eastern apses, there was a crypt under the choir (Monasticon, iii. 1095).

Ground Plan.—In the Norman and Transitional Norman church, the grand characterestics were the great length of the nave, at St. Alban's, Winchester, Norwich, Ely, Peterborough, Jorevalle, and Byland: a triapsal arrangement, the choir, shorter than at a later period, ending in an apse,* and the transept having an eastern apse to each wing; the latter feature appearing at Norwich, Gloucester, Romsey, Thetford, Castle-Acre, and Christ Church, Hants. Oxford, St. Cross, and Romsey, had a square east end. The ritual choir occupied the space under the central lantern, and included the first two or three eastern bays of the nave. The apsidal east end, as at Gloucester, Canterbury, Leominster (Arch. Jour., x. 111), and Norwich, often terminated in an aisle opening into one eastern and two lateral chapels. In 1250 aisles were added to the transept of York; and in 1370 a choir transept. Reading had three eastern apses, and two eastern apses in each wing of the transept (Archæologia, vi. 61.) Battle had three eastern polygonal apses (Horsfield's Sussex, i. 539). Wells and Lichfield have polygonal ends to the Lady-chapel. Eastward of the choir was the presbytery, with the altar standing in the chord of the apse, and the bishop's throne elevated on a platform behind it; the circular aisle behind forming a processional path. Apses are rare in the north, probably owing to the influence of Iona. Of a later period we have the "French Chevet," a circlet of pillars comprising aisle and a crescent of radiating chapels, as at Tewkesbury, Pershore, and Westminster. At St. Alban's the nave was filled with altars arranged against the piers. The central tower was at length commonly regarded as forming the natural division between the nave and choir; and this recognition, coupled with the introduction of eastern shrines and of a solid rood-screen, necessitated a complete reconstruction or prolongation to the eastward. Under the east tower arch the rood-screen was placed, and a reredos divided the new constructional and ritual choir from the retro-choir. (Viollet le Duc, s. v. Clôture.) Lateral stalls enclosed the choir, and open screens the presbytery; both partitions being inserted in the lower arcades. Access was thus permitted to the entire circuit of the church, without interruption to the choir services; the double aisles of the French churches served the same purpose more efficiently. The obstruction to the progress of a procession offered by the lateral chapels led to the erection of chapels external to the nave-aisles at Chichester, Manchester, Melrose, and Elgin. At Winchester, the reredos, with a more easterly screen, encloses the capitular chapel. At Westminster, St. Alban's, and Bury St. Edmund's, the retro-choir was occupied by the chapel and shrine of the patron saint. Crowland terminated in an apse without lateral chapels.—(Stukeely, Iter. Curios., i. 33.)

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* *ἁψίς*, a bow vault, round. Passon. Lex. Gr.; Lenoir, i. 148, 201, 276; ii. 91; Ducange, i. 31.

Crypt.—The original ground-plans of the eastern portions of churches may sometimes be traced in the early crypts; an apsidal oblong martyrdom at Winchester contains aisles, and a smaller apsidal crypt for the altar to the east.

Crypts were employed as chapels and oratories, charnels (where no distinct charnels were built), mortuary chapels, and chambers to secrete the church jewels in time of danger. They are two kinds, one a square hall, the other a subterranean church, with apses and aisles. They occur at Repton (Jour. Arch. Ass., vii. 263, 275), York (three-aisled), at Gloucester (three-aisled), Christchurch (an apsidal oblong), St. Peter's, Oxford, Bosham, Hythe, and of small size at Hereford (three-aisled), and Exeter, Ripon, and Hexham (Arch. Jour., ii. 239); in the latter two instances shaped like cells. Rochester has a crypt of seven aisles, full of chapels, but not apsidal, begun in the thirteenth century, (Jour. Arch. Ass., ix. 279, 281.)

At Westminster there was a crypt, as at Wells, with an altar under the chapter-house. Wells are found in them at York and Winchester; at York there is a lavatory. The crypt of Glasgow, of the thirteenth century, extends under and beyond the choir. A similar large crypt at Worcester wants the eastern lesser crypt, but is provided with an additional southern chapel (Britton's Cath.; Proc. Arch. Ass. Worcester, p. 105); and the perfect subterranean church at Canterbury, vividly described by Erasmus, with its iron grille round the tomb, is a three-aisled apsidal oblong, with a transept, having two apses in each wing, and apsidal chapels at the east, while beyond is a second apsidal oblong with aisles, and a round crypt at the extreme east end. The latest English crypt is that of St. Stephen's, Westminster. The apse of a church is generally its most ancient portion, as the choir was always the first part built, and was always rebuilt with reluctance, being devoted to the most sacred offices of religion, and invariably of the strongest construction.

The crypt of Chartres had a martyrdom of St. Denis, with an ambulatory and large chapels.—(Ducange, ii. 682; Lenoir, i. 209; ii. 157; Viollet le Duc, s. v. Crypte, iv. 447; St. Benigne de Dijon, of the eleventh century, is circular, with an eastern oblong chapel of St. John, and western ante-crypt, with four apses. St. Seurin, Bordeaux, of the eleventh century, is a nave of three alleys. St. Eutropius at Saintes, of the commencement of the twelfth century, is apsidal, of three alleys, with three radiating chapels. At Auxerre, there is an apsidal crypt of the ninth or tenth century, of three alleys, with an aisle all round, opening into a small east apsidal chapel. The reliquary and altar of the saint occupied the east end.

At St. Servais, Belgium, there was a thirteenth-century crypt of three aisles, retaining its altar within the apse till 1806; the second, or *caveau funéraire*, as M. Schayes calls it, remains. A subterranean church of the same period, c. 1078—1092, an oblong of five aisles, with a pentagonal apse, is to be seen at Anderlecht. That of St. Bavon was a square of three aisles (*ib.* iii. 24). The crypt of St. Avit (De Caumont, Rapp. Verb. S. F. A. 1859), of the tenth century, and St. Aignan, a century later at Orleans, are three alleys, with a martyrdom or confession under the sanctuaries, and an apsidal church beyond the wall which bisects the entire building.

Glasgow and Llandaff (Freeman's Llandaff) are oblong churches; Canterbury, Lincoln, Salisbury, Worcester, Rochester, Southwell, and Beverley have, like Clugny had, a choir transept; rudiments of a similar arrangement appear at Wells, York, Hereford, and Exeter. Martin (Hist. de France, iv. 338) mentions a similar but exceptional instance at St. Quentin's, but observes that the choir transept is ordinarily found only in abbeys of a period previous to the Ogival style. The stalls of the clergy, probably, reached from the choir transept into the nave (Viollet le Duc., i., 260), the choir transept being allotted exclusively to the clergy, and the western transept to the accommodation of guests. Durham and Fountains have an eastern screen; Peterborough, Lincoln, and Ely have

a western screen; Exeter has one in a smaller degree. The choirs of Rochester, Kilkenny, and Christchurch are isolated from their aisles. Dunblane choir is aisleless.

I have been informed that the ground-plans of Minsters* are invariably submitted to the Pope, and that many remain in MS. in the Vatican. We possess, however, the ground plans of St. Gall, Clugny, Clairvaux, Citeaux, and Clermont, which afford sufficient information for our purpose. The Benedictine (Viollet le Duc, i. 256) arrangement was uniform, a cruciform building with towers and chapels, marked by great magnificence. The Benedictine abbeys generally have a parish church immediately adjoining them.

Austin Canons.—Austin Canons, an order of regular clergy holding a middle position between monks and secular canons, adopted naves of great length, as at Jedburgh, Christchurch, &c. for the purpose of accommodating large congregations (Johnson's Canons, ii., 293; Peckh. Const., 1281; c. 16.), as they were a community of parish priests living under rule, and the prior's lodge is almost invariably attached to the south-west angle of the nave. The east ends are ordinarily square, and the choir—never very large—is sometimes, as at Llanthony (Arch. Camb. i., 201; i. 82, 3rd ser.), and Christchurch, shut off from its aisles. The towers are very seldom of any importance, and are generally additions of a late period at the west end, as at Christchurch (Ferrey's Christchurch), Dorchester (Addington's Dorchester; Arch. Jour., ix. 158), Bolton, and Waltham.

Cistercian.†—The characteristics of the churches of the Cistercians, like the Clugniacs, a reformed congregation of the Benedictine order, is an extreme simplicity in outline—absence of triforium and pinnacles, a single central tower, a simple west front, and plain undivided windows—for no ornament of any sort, not even of painted glass, was admitted—and a flight of stairs led from the transept into the dormitory. Clairvaux had a chevet, with nine radiating square-ended chapels; two east chapels in each wing of the transept and two in each of the western aisles of the transept. There was a large west porch; stalls for the clergy were set on the west of the transept, and for the servants at the lower end of the nave. Pontigny, c. 1150-70, where Lanfranc, Anselm, and à Becket, took refuge, had a chevet with seven square-ended chapels, and side chapels to the choir aisles, and west and east aisles to the transept; and Altenburg (c. 1255) has a chevet with seven polygonal chapels; the only English instance of such a termination has been discovered at Beaulieu, Hants, which, probably, resembled Clairvaux. Alcobaça, in Portugal—1148-1222—has a three-aisled nave, and a chevet with nine chapels. Notre Dame Ruremonde, begun 1218, is of the Rhenish type, having pentagonal apses to the choir and apses, a cupola, with two flanking central towers; and a large west transept and narthex (Schayes, iii. 50). In the twelfth century the order distinguished themselves from the Benedictines by the choice of a secluded spot and the simplicity of their ground plan, which, in its earliest type, was marked by a short square-ended choir, as at Holy Cross, Hore, Boyle, &c.; except at Rievalle and Fountains; often aiseless, as at Pluscardine, St. Mary Sweet Heart, Kirkstall, Roche, Furness, &c.; and by having chapels (usually four) on a line with the choir, and opening like an eastern aisle into the transept, as at Sylvacane, c. 1147 (Lenoir, ii. 47), Fontenay (c. 1119), Sernay (c. 1128), Clairvaux, and Novitac, built by St. Bernard, and St. Vincent at Rome. Citeaux was square-ended, but had apses to the transeptal chapels. Vaux de Sernay (c. 1128) was square-ended, with four apsidal transept chapels. Fontenay had a square apse, with square-ended transeptal chapels. This arrangement, which was adopted in the fifteenth and sixteenth

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* The term Μοναστήριον, whence our word Minster, applied to large conventual churches, is first used by Eusebius.—(Hist. Eccles., l., ii. c. 17.)

† Jour. Arch. Ass. vi. 309, 312; Ecclesiologist, cxxxiii.; Viollet le Duc, 207, 250, 264, 269; Fosbrooke, Brit. Mon.., 112.

centuries at Florence and Rome, appears in England at Kirkstall, Roche, Furness, Netley, Buildwas, Tintern, and Fountains, &c.; and in Ireland, at Dunbroody and Boyle. No Lady-chapel protrudes at the east end. The eastern aisle of the transept was always parted off into chapels (Arch. Jour., xi. 136). The exceptional instances of towers (both Perpendicular) occur at the west end of Furness, and on the north-west angle of the transept at Fountains. At Clairvaux (Viollet le Duc, i. 267), and ordinarily in Cistercian houses where the choir was aisleless, the whole space under the lantern was left open, so as to leave free access to all the eastern altars. The number of four transeptal chapels was sometimes increased to six, as at Rievalle, Fountains (Proc. Ass. Soc., i. 263; iii. 54), Furness, Kirkstall, Dunbrody, and Graig-na-managh. Jorevalle in 1154, presents an advance in the arrangement, having choir aisles; and Byland, which has western aisles to the transept. In France there was a large west porch.

*Friars.**—The churches of the Friars—Franciscan (*e. g.* Kilconnel), Dominican (*e. g.* St. Andrew's, Norwich), and Carmelite, *e. g.* Hulne, were oblong and of unbroken length, destitute of a triforium, and generally provided with only a single aisle or a single transept. The choirs are aisleless, generally flat-ended; but a Franciscan ruin at Winchelsea has an apse. The Franciscan church at Stirling has an octagonal apse. In the fourteenth and fifteenth centuries, tall, narrow towers, as at Roswick, Moyne, Multifernan, Adare, and Kilconnel, were inserted between the nave and choir. Ardfert has a west tower; the cloister is on the north at Moyne, Muckross, and Adare, on the south at Kilconnel. Kilconnel and Muckross have a south transept; Castle Dermot has a north aise and transept. Reading has a nave and aisles.

St. Andrew's, Norwich (Jour. Arch. Ass., xiv. 80; Harrod's "Gleanings") and the Dominican Friary (Schayes, iii. 153-4), at Louvaine, c. 1230, and at Gloucester, had a nave with aisles; that at Ghent is a square-ended oblong, c. 1240; so is Roscommon, but with a north nave aisle. Conventual buildings were arranged by the Dominicans, as at Sligo and Kilmallock, on the north, and their preaching-yard laid out on the west or south side. Hulne, a Carmelite church, is a mere oblong (Arch. Jour., iii. 141).

The Friars (Lenoir, ii. 205; Viollet le Duc, i. 297; Ecclesiologist, No. cxxxiii), owing to their destination as preachers, required to place their houses in the midst of a surrounding population; and had to adapt them to the irregularity of the site, large spaces of ground not being attainable. The stalls of the brotherhood occupied the nave, and the congregation occupied the parallel aisle. The cloister of the Jacobins of Paris and Agen were on the north side. The churches in those towns, as at Toulouse, were oblongs of two aisles, but the latter, of the latter part of the thirteenth century, has a chevet with five chapels. Chapels were not ordinarily added until the fourteenth and fifteenth centuries. The refectory at Toulouse and Paris stood out at right angles to the church. The Austin Friars' house at St. Marie des Vaux Verts, near Brussels, exhibits an oblong church without towers. On the north side of the cloister was the library, on the west the dormitory, on the south the refectory, on the east the day dormitory for the "meridian." On the north and south of the eastern cloister were the guest houses. The infirmary was detached on the south-west of the great cloister.

Præmonstratensians.†—Two of the most deformed ground-plans, in England, belong to the Præmonstratensian Regular Canons, a reformed branch of the same order as the Austin Canons. Eastby (Proc. Ass. Soc., ii. 317), with its long, aisleless choir, and nave wanting a south aisle, and Bayham, with an aisleless nave and lateral galleries to the transept. The choir is aisleless, but ends in a polygonal apse.

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* Fosbrooke, Brit. Mon., 117, 121.

† Lenoir, ii. 478; Fosbrooke, Brit. Mon. 115.

*Clugniacs**—The original Abbey of Clugny bears a marked resemblance to Lincoln Cathedral, built by John de Noiers for Hugh of Burgundy. A peculiarity of Clugniac churches in England is the position of the sacristy, which at Thetford and Castle Acre is attached to the north wall of the transept. In France, a narthex, or outer church for penitents, was a distinctive feature (Viollet le Duc, i. 185, 207, 259), as at Clugny, c. 1220; Vezelay, c. 1160; and Charité-sur-Loire, of the twelfth century, with two towers above the porch, four towers flanked the transept, and a central tower formed the lantern. The Abbey of Clugny was composed of a church with a nave with double aisles; a main and choir transepts, each with four apsidal chapels; an ante-church, a chevet with five chapels, and a cloister on the south. Above the great porch in Clugniac churches in France, a chapel of St. Michael was built. At Daventry and Tykford, the outer or farm-court was of considerable size (Monasticon, v. 206, 184)

West Front.—The ordinary west front in a fine building presented a gable between two towers. In the church of a nunnery, as at Romsey, there was no west door. The west fronts presented high-pitched roofs and gables, when stone vaults replaced the old flat wooden roofs, and were especially useful in the snowy and rainy North. The mystic triangle of the Trinity in the pediment was replaced by the gable cross; and triumphant angels, apostles, evangelists, saints, and stories from Holy Writ and legends, arranged over the front, formed a guide of Christian life and vast systems of instruction. Occasionally, on a German type, in the central compartment there was a western tower, as at Belvoir, Ely, Hereford; imitated afterwards at Bolton, Wimborne, Christ-church, Hants, Shrewsbury, and Waltham. The same plan is observed at Mechlin, Limerick, Dantzic, Roeskilde, St. Vincent's, Soignies; St. Gertrude's, Nivelles; at Fribourg, St. Germain des Prés; St. Savin's, and St. Benoit-sur-Loire; but they were soon placed at the angles to show the arcading and windows of the front. We also find a western church attached, as at Sherborne, Glastonbury, and Tynemouth (Mon., iii. 311; Collinson's Somerset, ii. 263; Harston's Sherborne); and similar instances in the Clugniac churches, and St. Front's, Perigueux.

Porches.†—A Galilee (Ducange, s. v.; Lenoir ii. 80) occurs at Durham, Ely, and Snettisham: it may have derived its name from being the most distant portion of the church from the altar, or from the circumstance of its being used like a lych-porch for the dead, with a touching allusion to the fact that our Saviour, after His resurrection, showed Himself so frequently to His disciples in Galilee. The third week after Easter by the Greeks, and Wednesday in Easter week by the Latins, was called Galilee from this circumstance. This porch was used as their last station by processions. It is found on the south side of the transept at Lincoln. The porch was probably a vestige of the narthex of the primitive church. In it the children of the abbey serfs were baptised, and the office was said, at which the domestics assisted. It was also used on Palm Sunday to arrange the procession and to receive great personages in bad weather. At Clugny it was as large as a church. It was often a sanctuary, containing a ring which the fugitive clung to, as at Durham (Fosbrooke, Brit. Mon., ch. xlix) and at Cologne, where there was an inscription, "Hic stetit magnus reus." It was also used as a parlour for conversation with persons who were permitted to enter the actual monastery. On the stones the measurements of weight and length were sometimes carved, as on a nave pier at Old St. Paul's. In the twelfth century porches were often superseded by grand portals. There are large porches at the west end of Peterborough and Chichester, south transept of York, and the north transept of Westminster. Large northern porches were added on the town side at Salisbury, Wells, Hereford, Christchurch, Worcester, Wells, Durham, &c.

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* Fosbrooke, Brit. Mon. p. iii.; Viollet le Duc, i. 257, 250.

† Lenoir, ii. 73.

Gallery.—The Gallery in front of churches took its origin from the necessity of accommodating the choir, who sang "Laus, Gloria," &c., when the procession on Palm Sunday returned from carrying the sacrament to the cemetery. Frequently windows were grouped closely for this purpose, and this may have been the design of the huge west arch at Tewkesbury. In bad weather the ceremonial was held before the altar of the Cross, under the choir-screen, and this custom may have led to the construction of minstrel galleries at Winchester, Exeter, and Malmesbury. Galleries are found at the west end of the nave at Le Mans and Jumiéges in the north transept, and in the north nave aisle at Winchester, in both transepts at Bocherville, in the south transept at Westminster, Hexham, and Cerisy, and like a small arcade at Elgin.

Doors.—The north nave door was allotted to the laity, that on the south opened into the cloister, the exceptions are where the conventual buildings were on the north side of the church. Romsey, being the minster of a nunnery, has no west door.

Towers.—Towers had frequently an altar of St. Gabriel or St. Michael, the conductor of souls (perhaps in allusion to the Paradise below, or the legend of his apparition, c. 490 and 706), (Johnson's Notes, Ethelred's Eccl. Laws, 1014, c. 2), and the interior was frequently covered with sepulchral inscriptions. A chapel of St. Michael, in Clugniac houses, was built above the great door. The great tower of St. Benoit-sur-Loire, c. 1026, was called St. Michael's; the central tower of Canterbury is called the Angel Tower; and on the highest gables of Wykeham's colleges are statues of St. Gabriel or St. Michael. Three towers were built at Canterbury, York, Wells, Lincoln, Durham, Llanthony, Southwell, and Ripon, as at Westminster, built by Edward the Confessor (Publ. Rec. Comm. 1858, p. 244); Lichfield alone retains its three spires. Ely and Peterborough have central lanterns; Salisbury, Norwich, Chichester, and Oxford have central spires. Two western towers were designed at Norwich and Chichester. At Chichester, as once at St. Paul's, Salisbury, and Westminster, Worcester (Arch. Inst. Worc., 103; and Crowland, Proc. Ass. Soc. iii. 273), there is a detached belfry-tower. At Rochester it is attached to the north transept; at Dunblane to the south transept. At Wymondham (Monast. iii. 328; Arch. Inst. Norf. vol. 1851, p. 115), the abbey steeple, built over the three eastern nave-bays, shuts off all communication with the nave, which served as a parish church. Aberdeen and St. Andrew's have two west towers. Elgin had three towers, with large turrets flanking the east end. Fortrose has a single west tower. At Exeter the towers form transepts—a very convenient arrangement for the monks (Viollet le Duc, i. 168), when tolling the bells for the night offices, or when a large congregation filled the nave. The same arrangement prevailed at St. Germain des Prés, Clugny, Vezelay, and Chalons-sur-Marne. The western towers contained the bells rung on feast days, and as a summons of the laity to service. There are towers to the choir transepts at Canterbury, and tower-turrets at the west end of Salisbury, and Peterborough, and Rochester, to the east end of Chichester, and Exeter, and Norwich, to the transepts of Peterborough and Ely, and at the west and end of Winchester. Turrets flank the choir of Peterborough.

Transept.—There are aisleless transepts at Canterbury, Norwich, Carlisle, Worcester, Gloucester, Exeter, Rochester, Kilkenny, Romsey, and Bristol; but the place of an aisle was ordinarily supplied by the erection of eastern apsidal chapels or square, as at Exeter. St. Patrick's has a quasi-aisle. St. Stephen's, Caen, as Canterbury had, has an internally formed lateral aisle. Scotland, like France, ordinarily presents only a quasi-transept. Transepts with east aisles for chapels are found at Peterborough, Hereford, Lichfield, Selby, Whitby, Ripon, Lincoln, Roche, Jorevalle, and Howden. Double aisles flank the transepts of Winchester, Ely, York, Wells, and Byland. One of the compartments at Winchester retains its name of the calefactory, the place for lighting the censers. A stone confes-

sional chair remains in the south transept of Gloucester, and confessionals are to be seen at Maig-Adaire (Fosbrooke, Ency., i. 122). The revestry, as at Westminster, Gloucester, and Christchurch, was attached to the transept; it contained a press for vestments (one remains at Winchester), an altar, and a bell to announce the coming of the celebrant. Transept towers occur at Exeter and St. Mary Ottery, and in Cormac's chapel, on the rock of Cashel, consecrated 1134, as at St. Stephen's, Vienna, Narbonne, and Chalons-sur-Marne. At Angoulême there are towers at the ends of the transept. At St. Lambert's, Liege, there was a south transept tower (Schayes, iii. 136). Choir transepts are added at Salisbury, Lincoln, &c., as at Clugny and Nivelles. In the sixth century St. Germain built chapels in the transepts of St Vincent's. The chapels were usually founded as sepulchral chantries, and supported by families of distinction, or by bequest of ecclesiastics. There are superb western transepts at Ely, Lincoln, and Peterborough.

The word choir* is first used by writers of the western church, and Isidore, of Seville, derives it from the (corona) circle of clergy and singers who surrounded the altar (Orig., lib. i. c. 3); it occurs in the c. 18 of the 4th Council of Toledo. The position of the ritual choir in the nave may be ascertained by a difference in the shape or ornamentation of the pillars, the presence of a piscina, or marks of the rood-beam. Priests' rooms are found over the vaulting of the nave and choir at Mellifont, Holy Cross, and Kilkenny. In abbeys the choir (Viollet le Duc, iii. 227), raised by steps above the level of the rest of the building, usually extended into the nave, from which it was divided by a rood-screen; and on this side of the transept was the altar for matins and lauds, the nave being left for the guests, pilgrims, &c. Romsey has a raised platform in the nave aisles for the stalls of the nuns. In the cathedral the choir usually commenced on the other side of the transept, which was given up to the congregation; the large aisles were for their accommodation on the same level with the choir, and no stalls obstructed their view. Between the high altar and the bishop's throne, which was placed in the apse, stood a low or matin altar, with the vestment of the celebrant on a stand, and a brazier for kindling the incense. On each side of the entrance of the sanctuary stood a seven-branched candlestick.—(Comp. Fosbrooke, Encycl., i. 124.)

The apse or chevet took its origin in the junction of the common circular tomb-house of the east end, found behind the altar with the basilica, by the removal of the intermediate walls. The tomb-house is still existing, under the name of Becket's Crown, at Canterbury, an imitation of the east chapel of Sens, and like Henry VIII.'s chapel at Westminster; Trondhjem, Batalha, Burgos, and Murcia. Romsey has apsidal terminations to the choir aisles: the central compartment once formed probably an apse (Proc. Arch. Inst., Winchester volume). The choir is disproportionally short at Westminster, Brecon, Brinkburne, and in several Cistercian abbeys. Stalls were introduced at the close of the thirtenth century (Schayes, iii. 125), when the choirs were lengthened and arranged in two tiers. The earliest instances of wooden seats occur in a constitution of Grostête, in the early part of the thirteenth century. Three-legged stools were an earlier substitute; there is a mention of their use in the fifteenth century, and of choir-stalls in the Black Book of Swaffham. Lenoir mentions that Romanesque stone stalls remain at Ratzburg (ii. 135). The choir in cathedrals, following the monastic usage, was previously walled off from the aisles by a low partition (Schayes, Hist. de l'Arch., iii. 126), as at Canterbury, Alby, Chartres, Bourges, St. Denis, Amiens, and Notre Dame: in the two latter instances carved with figures. A solid wall still incloses Rochester. The bishop's throne was, when stalls were introduced, removed to a seat in the choir. Sick and strange monks sat in the retro-choir.

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* Wal. Strabo, i. c. 139; Durand, i. 1—18; Lenoir, i. 183; ii. 249; Honorius, 1, 140; Ducange, ii. 336.

Lady-chapel.—The earliest Lady-chapel was built at the west end of Canterbury, and re-erected in the north nave aisle by Lanfranc, but did not assume a prominent position till the thirteenth century (in Belgium, in the fourteenth century—Schayes, iii. 105), and then was usually placed eastward of the choir. It occupied the south choir aisle at Elgin, and the north at Thetford, Hulne, Belvoir, Bristol, Oxford, Llanthony, Wymondham (Monasticon, iii. 328), and Canterbury; but was detached at Ely and St. Martin des Champs; is on the north side of the nave at Waltham and Rochester; on the south of the choir at Ripon (over the chapter-house) and Kilkenny; in the south transept at Wimborne; at Lincoln and Gloucester it is cruciform; at Lichfield and Wells it has a polygonal apse; is in the galilee at Durham, and in the south transept of Wimborne. At Christchurch there is a chantry over the Lady-chapel.

An inclosed baptistery, like that at Luton, is found at Cividade de Friouli, of the eighth or ninth century. At Canterbury it forms a round building near the choir.

At Fountains the marshalling of processions was marked out by stones along the nave, and a line of demarcation to women drawn across it at Durham, as at Canterbury and York formerly (Fosbrooke, Encycl., i. 125). A curious acoustic arrangement of pottery was found under the rood-screen at Fountains. The pulpit (Ducange, vi. 263; Lenoir, i. 98, 217; ii. 76; Viollet le Duc, ii. 406) was on the south side of the nave. In Italy stone pulpits are found of the thirteenth and fourteenth centuries, as at Sienna and St. Miniato, Florence. In the twelfth century, as at St. Augustine's, Canterbury, and Bury St. Edmund's, pulpits were used in French churches, but probably were only moveable wooden lecterns. In the thirteenth century they became usual, owing to the establishment of the preaching friars, and their employment in the refectory; the earliest is that of Beaulieu. In the fourteenth and fifteenth centuries we find an open-air pulpit in the cloisters or court; as at St. Die, at the Friary, Hereford, and Magdalen College, Oxford; Bishop Latimer preached in Privy-gardens, and his contemporaries at Paul's Cross. In churches they appear first in the Perpendicular period. There is a stone pulpit at Wells. The bishop's throne (Lenoir, i. 205; ii. 115, 239; Viollet le Duc, ii. 22, 279, 414; Ducange, s. v., Cathedra) was formerly of stone, as at Canterbury, Norwich, Avignon, St. Vigor, and Rheims. At the close of the fifteenth century they began to be of wood. Sedilia, rare in France, are found in Normandy and Brittany, and appear in England at the close of the twelfth century. There are generally three seats connected with a piscina in England, but four occur at Furness and Paisley, and five at Southwell. In place of the triumphal arch of the basilica, a trabes (Lenoir, i. 186) was set up, richly carved and adorned with tapers. An altar of the crucified, used in the ceremonials of Palm Sunday, was erected in the nave of St. Gall, round which the sick monks on All Saints' Day took their place. The most ancient in Belgium is that of Louvaine (Schayes, iii. 127), of the sixteenth century. The finest in France is in the Madelaine, Troyes.

At St. Ambrose, at Milan, and St. Miniato, at Florence, altars, as was usual in Roman churches, were placed in front of the choir. A screen was added in the thirteenth century, and this addition was multiplied in the two following centuries (Schayes, iii. 126). It was used for reading the Epistles, Gospel, certain lessons, letters of communion, edicts of bishops, and acts of councils, and in some places for the benediction of the bishop, whence its name of Jube. At Clugny the laity were communicated at the rood-loft through a grille. They took the place of the ambo and lectern of the basilica, and were used for the reading of the Gospel and Epistle, and at a later date for the organ and singers. They were composed generally of a central door, closed by a curtain during the celebration, as the ciborium had been veiled, and in the lateral arches were placed altars.

*Screens.** — The rood-screen took its origin in the necessity of protecting the monks from draughts of cold air. As a compensation to the laity for their exclusion, two kinds of screens were introduced, identical in principle, though varying in position and arrangement. One was the choir-screen, in which, as at Chichester, Exeter, and St. David's, an altar was placed on either side of the great entrance from the nave. The second was the nave-screen, in which there was a central altar, forming the matin altar and high altar of the laity, set between the two rood doors, as that of St. Cuthbert's at St. Alban's. At Guilden Morden (Lysons' Brit., ii. 59) there is a double rood-screen. At St. Alban's they formed a loft used as a dormitory by twelve monks. The rood stood over the choir-screen at Canterbury, but at St. Alban's over the presbytery-screen, a piece of furniture the original of altar-rails, which is still found at St. David's (Jones' and Freeman's St. David's, p. 89). At Christchurch, Hants, the screen stood in the first compartment of the nave westward of the lantern, as at Tintern, Fountains, and Winchester. The screen is placed in the second bay westward of the lantern at Buildwas and Norwich; at Westminster and St. Alban's in the third bay; in the sixth bay at Tynemouth; and in the fourth bay at Jorevalle. Various par-closes screened off chapels in the nave, transepts, and aisles; often, as at Fountains and St. Alban's, blocking up the nave. Against these enclosures and between arches, the tombs of bishops and abbots were placed, but at length were developed into distinct chantries; the earliest instance being that of Edyngdon, at Winchester.

The reredos behind the altar is found at St. Mary's Overye, Winchester, Westminster, St. Alban's and Christchurch. Immediately behind it, to the eastward, was the shrine of the Patron Saint, as that of Hugh at Clugny; St. Louis at St. Denis; at Winchester, St. Alban's, Bury, Durham, Bridlington, Lincoln, Lichfield, Westminster and Canterbury, where the east processional path is on a level with the chapel, but with the floor of the nave at Durham and Westminster. The shrines of Saints were in subordinate positions: at Rochester, choir transept; Chichester, south transept; St. David's, north side of choir; and Oxford, in a north chapel.

Watching lofts to observe the shrine, remain at Oxford, St. Alban's, Westminster, Worcester, and Canterbury. Chambers for the watchers of the church may be seen at Lincoln (Fosbrooke, Brit. Mon., p. 283), and over the north porch of Exeter. Minstrels' galleries are found at Exeter, Malmesbury, Winchester, St. Mary Ottery, Gloucester, and, perhaps, Westminster. The cell of a recluse remains at Norwich (Proc. Ass. Soc., ii. 349).

Wall Passages.—The triforium (Ducange, vi. 669), which at a later period was treated merely as a portion of the clerestory window, was at first designed to combine (Lenoir, ii. 103), additional height with constructional security, and was used for purposes of accommodation, for a passage, and for hanging tapestries on festivals; it is locally called the nunneries at Christchurch, Durham, and Westminster, where the great size of this gallery was a continuation of the plan of this story in the Confessor's church (Vita S. Edw., Publ. Rec. Comm. 1858, p. 417), which contained altars, and was retained, probably, for the accommodation of spectators on grand ceremonials. It is a feature never found in a Cistercian church. The peculiar wall-passages in the lower story in the same church were used by the abbot for the purpose of supervising the monks. The prior's gallery still remains at St. Bartholomew's, Smithfield, and was probably of a similar destination. The wall passages of the clerestory were probably used by the sacristan when he went round to secure the shutters of the windows, then unglazed or merely latticed, in case of rain or storms. The windows were formed of stone, pierced with circles or tracery, like trellis-work in the early churches of the West and East. Glass

* Viollet le Duc, iii. 465; Durandus, iv., c. xviv.; Hier. Angl., p. 66.

windows are, however, mentioned at an early date.* Gregory, of Tours, speaks of wooden sashes glazed in France, however (Glor. Mart. i.; c. lix.), and in 1052, stained glass is described at St. Benigne de Dijon.

A labyrinth (Lenoir, i. 184; Arch., Jour. xv. 218), to thread which was a compensation for a pilgrimage to Jerusalem, is found at Canterbury, and St. Bertin's, St. Omer's; St. Michael's, Pavia; St. Quentin's; Aix; Chartres; St. Maria in Aquino; Lucca, and St. Maria in Trasteverino, was introduced in Belgium in the thirteenth century (Schayes, iii. 119). The fridstool, or chair of sanctuary,† remains at Beverley and Hexham. The Tabernacle is often an aumbry near the high altar, on the north side. A credence-table remains at St. Cross. After the thirteenth century credences (Viollet le Duc, iv. 372), were introduced in Belgium (Schayes, iii. 123), generally on the right and often on the left of the altar; the latter, divided by a slab, held a basin and cruets, and was furnished with a water-drain below; that on the right was an aumbry, and held the books and ornaments of the altar. An additional aumbry served to keep the holy oil. The piscina was ordained by Pope Leo IV. for cleansing the chalice. It became an important piece of furniture in the thirteenth century, and was provided with a stone bracket for the sacred vessels, and two drains, one for common water, the other for the rinsings of the chalice. Aumbries for the books and processional crosses also remain. An ancient clock brought from Glastonbury, is found at Wells. The "horloge à roues" is attributed to Gerbert, Archbishop of Rheims, or to Pope Sylvester II., c. 1003. The Cistercian rule xxi. prescribed their use, though sun-dials continued in use. The altars had no retables or crucifix, until the end of the thirteenth century (Schayes, iii. 121; Walafrid Strabo, i. c. 139).

The *sacristy* (Ducange, v. 759; vi. 148; Lenoir, ii. 287, 367) ordinarily intervened between the chapter-house and the church; but is found on the north side of the choir at Thornton; south side of the choir at St. Mary's, York, Lichfield, Leiston, Hulne, Selby, and Furness; and at the east end of the choir of St. Mary's Warwick, and Malvern; in conjunction with an almonry on the north side of the north transept at Castle Acre and Thetford; and on the south of the south transept at Westminster. It is very possible that the name of the so-called castellan's rooms at Christchurch was a corruption of sacristan's rooms, they being situated on the north-east angle of the nave. The sacristy at Noyon was a two-storied circular building, opening on the east side of the transept.

Conventual Arrangement.‡—There was a generally understood rule and an evident similarity in the ordinary mode of conventual arrangement. Where exceptions occur they may be readily traced to some easily assignable cause: (1) the retention of earlier buildings; (2) the habits and requirements of a particular order of monks, or their transfer as architects, or bishops over another order; (3) the nature of the site, existing streets, or old town buildings; (4) defence in exposed situations; (5) modifications of the primitive rule and rearrangement of the buildings at a subsequent period, from emulation with others, from the love of reconstruction, for convenience, grandeur, or imitation of adjoining churches; (6) the perpetuation of the plan of the mother church and convent, by imitation in its cells; (7) the confusion in arrangement, owing to the necessity of providing accommodation for kings, nobles, and guests of distinction, for synods, and sometimes parliaments.

In the case of the lonely Carthusian houses (Viollet le Duc, i. 307; De Caumont, Abec., 178; Monasticon, vi. p. 9),—for instance, Mount Grace,—the oratory and cloister were tomb-like. The brethren lived apart in little cells, each provided with three little rooms and a garden; and only left

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* S. Chrys. t. viii. p. 354; Lact. de Opif. Dei., c. viii.; Fortunatus; Carm., ii. p. 11.

† Jour. Arch. Ass., xiv. 97; Canute's Ecc. Can., 2; Aldhelm's Trans. Ps. lx. 9, xciv. 22.

‡ Proc. Ass. Soc., i. 177, 293; Churton's Monastic Remains; Schayes, iii. 134; Viollet le Duc, i. 282, 253, 279, 302, 305, 409; iii. 409; Lenoir, ii. 197, 201. The plans were, probably, reserved to the corporate body, and transmitted by oral tradition, which would account for the absence of documentary evidence.

them thrice daily for church, or refectory on certain days; while they assembled in the cloister-court on eves to read over the lessons appointed for the matins of festivals. At Clermont there was an outer court with cattle stalls and a watch tower on the west, the guest-house on the south, barns on the north, and the prior's lodge on the east, and the apsidal oblong church, flanked with chapels; to the south of the church was the cloister, with the refectory on the south and the chapter-house on the east. To the east of the church was a large garth, surrounded by separate cells.

Each monastery included (1) a cloister-court; (2) an inner court, with the infirmary, guest-house, kitchen, servants' hall, library, &c.; (3) great or common court, with a double gateway, the larger arch being designed for carts, granaries, stables, store-rooms, grange-barn, servants' rooms, tribunal, prison, and the abbot's lodge: a remarkable instance occurs in the Præmonstratensian Abbey of Ardaines, near Caen; (4) the court of the church, or close, open to the public; and (5) mills, gardens, orchards, &c. There was a court called Romeland—probably from rome, roomy, as in Romney, Romsey, &c.—in front of St. Alban's; known as the Forbury (Monasticon, iv. 39) at Reading; and at Norwich as Tombland, at least since 1302 (Blomefield's Norfolk, iii. 67). By the Benedictine rule (Fosbrooke, Brit. Mon., 112; Fleury, xxiii. 14, 19; v. 207, 213; Monasticon, i. pr.), where six hours were assigned daily to manual labour, every trade and occupation necessary to the convenience of the community were domesticated within the walls.

In the plan of St. Gall, of the ninth century, the library abuts on the north wall, the sacristy on the south wall of the choir. The abbot's house, outer school, and guest-house lie parallel to the north transept and north nave-aisle. To the east of the church are the garden, cemetery, infirmary, and novices' house; to the south is the cloister, with the dormitory on the east, the refectory on the south, and the cellarage with a larder above it on the west. The poor man's hospice, composed of chambers enclosing a common-room, fronts the guest-house. To the west and south were farm buildings and workshops. The hospice for stranger monks had a common-room and a dormitory. The guest-house comprised a large refectory, sleeping chambers, stables, servants' rooms and domestic offices. The almoner's rooms were on the north-west side, those of the porter on the south-west of the church. The outer school, to which a master's house was attached, contained a large room, parted by a screen, and opening on the bed-rooms of the scholars. The infirmary and novices' house each comprised a cloister, refectory, dormitory, and a chapel, which separated the two courts. The abbot's lodge, of two stories, contained in the base tier his sitting and bed rooms, under his solar and oratory. The servants' house was detached. Between the church and the cellarage were the parlour and vestibule for the reception of visitors, and giving orders to servants. In the sacristy the lower story contained presses, chests, and the altar plate; the upper room held the vestments, and communicated with a room used for baking the sacred bread and preparing the consecrated oil. The library stood over the scriptorium, which was provided with desks. Under the dormitory, from which one staircase led into the transept and a second to the cloister, was the common-room, with a fireplace, and connected with the bath-house. The refectory was provided with a vestry for the ordinary robes of the brotherhood. The abbot's triclinium stood at the top of the room; the brothers sat along the side walls on benches; the guests' table occupied the centre, and faced the reader's pulpit. The kitchen and buttery communicated with this room.

The earliest plan extant of an English monastery (Lenoir, i. 28; Hasted's Kent, iv. 259) is that of Canterbury, made c. 1130-74. It embraces in the cloister court, which was on the north of the church, a chapter-house on the east, with the dormitory in a continuous line with it, the refectory on the north, and on the west the cellarage and store-rooms. Behind the refectory was the kitchen, southward of a second court, in which the guest-house was on the west, the parlour on the north, and

on the east a gate. To the east of dormitory was a cloister ranged round a herbary garden, and connected with the infirmary, which lay again to the eastward. The court-gate adjoining the guest-house, forming the principal entrance. In the herbary court the prior's lodgings were on the east; and to the north of the bakery, granaries and offices, which occupied another court.

At the close of the twelfth century Clairvaux, Cistercian (Viollet le Duc, i. 269), had the following plan:—A cloister on the south side of the church, with a lavatory; on the east side of the garth the sacristy, preceded by a little library next the south transept, with the great library above it approached by stairs out of the transept; the chapter-house of three alleys, with the parlour and old abbot's lodge extending southward under the dormitory; on the south side the parlour, the refectory of three alleys, and kitchen; on the west side, but detached, the cellarage; on the south-east of the choir was a small cloister, with carols for the copyists in the north alley, and a large hall for conference on the south. To the east again were the infirmary and novitiate, and more to the southward were the abbot's lodge and infirmary cloister. The stables were on the north-west side of the church. At Citeaux, the mother of the order, the arrangements were much the same. A little chapel adjoining the gate, to which the abbot conducted all guests before entering the monastery, and a stable conveniently adjoined it. The great cloister contained the cellarage on the west, slightly detached by a passage, with the guest-house and abbot's lodge to the southward; on the south were the kitchen, the refectory, and parlour; on the east the dormitory, chapter-house, and sacristy; in a second cloister to the east was the library above the carols of the copyists at the north, and the infirmary on the east. Pontigny had its cloister on the north, with cellarage of two alleys, and the rooms of the conversi above; on the north the refectory, kitchen, and calefactory; on the east the sacristy, chapter-house, novitiate, and wine and oil presses; on the west of the church were the abbot's lodge and guest-house. The cellarage was on the west at Vaux de Sernay.

The Clugniac Monastery of St. Martin-des-Champs has its cloister on the north side; the refectory and parlour on the north; cellarage on the west; the sacristy, chapter-house, and large halls, under the dormitory on the east; a detached Lady-chapel on the north of the choir, the small dormitory running parallel to it, more northward. At St. Geneviève the refectory is on the west, with the kitchen on the south. At St. Germain-des-Prés the refectory is on the north, the chapter-house on the east under the dormitory, and the cellarage on the west.

*Cloisters.**—The eastern monasteries had an enclosure, round which the houses of the community were ranged, and connected by a colonnade, as at Sta. Laura, Mount Athos, and St. John's, Constantinople. But in the West, where the churches were of far larger dimensions, and frequented by women, a different arrangement was inevitable. There were ordinarily two cloisters; the common, or great court of the religious; and the smaller or private court, used for conversation, by the copyists, for the residence of the abbot and dignitaries, and adjoining the library, cemetery, and infirmary. At Abingdon the earliest cloister was a mere enclosed space within walls (Chron. Abingd., ii. p. 271); that of St. Cuthbert, at Durham, was circular; while in the reign of Charlemagne, St. Angilbert gave a triangular form, for symbolical reasons, to the court of Centula, which contained two chapels of SS. Mary and Benedict. The cloister appears to M. de Caumont (Abec. Arch. Civ. 4), and Fleury, to have been framed on the model of the peristyle of the Roman city house; the outer or farm court on that of the country villa. The triclinium reappears in the refectory, in the garth the xystus; the church in the atrium; and the exedra in the chapter-house; the kitchens and lesser rooms, hospitium, hybernaculum, tablinium, etc., preserve their original

* Lenoir, ii. 298; Ducange, ii. 386; Fosbrooke, Brit. Mon. Ch., xxxviii.; De Caumont, Abec., 26; Viollet le Duc. iii. 408.

position in the monastery; the walled park, gardens, servants' and store rooms are equally familiar features to the classical student.

Cloisters were originally built of wood; until the twelfth century, and even at a later period, a timber roof was employed, and the corbels which supported it remain at Beaulieu, and in other places. The cloister is mentioned by Brakelond, c. 1173. It is wanting at Fountains, Kirkstall, Jorevalle, Stoneleigh, and Wroxhall. In the thirteenth century, alleys surrounding the garth are found at Salisbury and at Peterborough; and in the fourteenth century at Norwich; Wells, Chester, and Chichester, and Hereford had only three alleys. The cloister occupied the north side at Canterbury, St. David's, Chester, Gloucester, Buildwas, Milton Abbas, Sherborne, Tintern, Paris, Noyan, Rheims, Rouen, Beauvais, Seez, Bayeux, Puy-en-Velay, Cartmel, and Magdalen College, Oxford; and on the west at New College, in the same university; on the north of the choir at Lincoln; and on the south of the choir at Rochester. In cathedrals the bishops often took the south side as the best, and left the northernly to the canons. The church invariably formed one entire side of the cloister, which nearly always was to the south in northern countries, in order to secure as much sunshine as possible.

The cloister-close in cathedrals was surrounded by the houses of the canons. In the twelfth century the canons built private houses round the close (Viollet le Duc, iii. 410; Lenoir, ii. 495; Schayes, iii. 133; Monasticon, vi. 39, 141). It must be borne in mind that Winchester, Canterbury, Durham, Norwich, Rochester, Worcester, Chester, Gloucester, Peterborough, and Westminster, continued to be Benedictine abbeys, and Bristol, Oxford, and Carlisle as Austin Canons' houses, until the reign of Henry VIII. In the former, out of deference to the bishop, the superior bore the name of prior, and not of abbot. At Ely the bishop occupied the abbot's seat. With the exception of St. David's, the Welsh, the Irish, and Scotch cathedrals, and collegiate churches, as Lichfield, Ripon, Manchester (Jour. Arch. Ass., vi. 191); Wimborne (Mayo's Wimborne, 1860), Beverley, Lincluden, Perth, Southwell (Jour. Arch. Ass., viii.; Arch. Inst. Lincoln, 214), York, and Wolverhampton, had no cloister. Maidstone (J. Whichcord's Maidstone) preserves its collegiate arrangement. The capitular buildings included, ordinarily, a chapter-house, cellarage, schools, a vicar's close, as at Hereford and Wells (Jour. Arch. Ass., xiii. 34), library, audit-hall, bursary, prison, and tribunal.

The common monastic arrangement was the following:—On the north were two doors into the church; on the east of the great cloister were the sacristry, chapter-house, and the calefactory, with the dormitory, approached by a separate staircase above them; on the west were the cellarage and store-rooms and the guest-house; on the south, fronting, but thus removed as far as possible from the church, to secure it from noise and the smell of dinner, was the refectory, connected with the kitchen. Such is the description given in some old Latin verses preserved by Du Cange; and the arrangement is found towards the close of the eighth century at St. Wandrell's, Fontenelle, Upper Normandy; and at Beauport, Côtés du Nord, at the commencement of the thirteenth century. Boyle and Netley present the anomaly of a wall and gate occupying one side of the great cloister.

In the North Alley at Beaulieu, Melrose, and Gloucester, the carols of the monks, recesses for copying books, still remain. In the foreign abbeys they were usually in the smaller cloisters. In Cistercian houses this alley was appropriated to moral collations or lectures. Peter de Blois says the west side was allotted to the novices, and the east walk to prælections; the latter were selected from profane authors. Lanfranc mentions that the cloister was designed for conversation at certain hours of the day. The Benedictines used the cloister, and the Carthusians, Cistercians, Trappists, and Carmelites the garth, for interments. The cloister was under the control of the prior, sub-prior, and

several other officers. It is observable that at Winchester, until a recent period comparatively, the scholars in summer time studied in the cloisters. In the centre of the garth, which was planted with trees and flowers, was generally a fountain, and sometimes a pulpit used in the festival of All Souls.

*The Chapter House.**—It was so called, according to Papias, because the rubrics of the statutes of the order were daily read over to the monks in this room. In the ninth century the alley next the church was used as a chapter-house. In 966, Herleve, wife of Duke Robert of Normandy, built a separate chamber for the purpose at Fontenelle. Edward the Confessor built "a vaulted and round" chapter-house at Westminster (Vit. S. Edw., Publ. Rec. Comm. l., 2309). In the twelfth century one in the form of a parallelogram was built at Bocherville; a square or oblong is found at Buildwas, Castle Acre, Shrewsbury, Wenlock, Stoneleigh, Glastonbury, St. Mary's, York, Oxford, Bristol, Chester, Exeter, Gloucester, and Dunkeld. From the commencement of the thirteenth century a polygonal shape was adopted, and of this and the following century we find a decagon at Lincoln, Bridlington, and Lichfield; and an octagon at Westminster, Howden, Kenilworth, Cockersand, York, Sarum, Elgin, Pluscardine, Thornton, and Wells; and a round at Worcester. It is two-storied at Glasgow. In the thirteenth century it was sometimes divided into aisles; there are two at St. Pierre-sur-Dives, Dadeix, and Kirkstall; and three at Tintern, Netley, Fountains, Beaulieu, Jorevalle, and Buildwas. In was in this country probably a Cistercian; and certainly, as it is found at Fontenay at the close of the twelfth century, a French arrangement which was followed in Belgium (Schayes, iii. 134). At Wells and Westminster it is built above a crypt; it stands on the north side of the church at Wells. At Dumblane it occupies the east end of the north nave-aisle. It was provided with a stone bench along the walls, and with a seat for the abbot at the east end. Occasionally a chapel was adjoined, as at Batalha; and the apsidal termination found in the House of the Jacobins at Toulouse, Reading, Llanthony, Durham, Ripon, Haughmond, and Norwich, may have served for a similar purpose. The chapter-house chapel at Tongres retains its stone altar (Schayes, ii. 148). As it was the place of judgment on refractory monks, cells (Proc. Ass. Soc., ii. 289) are sometimes found adjoining it, as at Durham and Norwich. It was regarded as inferior only to the church in its sacred character, and a light not uncommonly burned perpetually in it. Bishops were interred in it at Durham, and persons of distinction at Gloucester. It frequently had two large openings on either side of the west door, as at Combe, Haughmond, Bristol, and Beaulieu, to admit light, and to enable the priors and monks of dependent cells to take part in the proceedings on important occasions. It is approached through a vestibule at Chester, Bristol, St. Mary's (York), and Kirkstall; and by a passage at Wells, Southwell, York, and Lichfield; at Belvoir (Nichol's Leic., ii. 80) it stood in the centre of the cloister.

The *Slype* was a narrow passage between the transept and the chapter-house, which occurs in the Benedictine houses of Winchester, Gloucester, Durham, Finchale, and St. Alban's, where it led to the monks' cemetry. Its place is supplied by the *Sacristy* in Cistercian houses. It occurs in the Clugniac convent of Bromholme, and in that of Austin Canons at Newstead.

The *Dormitory*† invariably adjoined the church, as the monks had, on the mornings of certain festivals, to sing matins at an early hour. For this purpose the Cistercians constructed a staircase out of the south transept leading to the dortor, and it usually extends in their houses over the chapter-house. It appears in the same position at Beleigh (Præmonstratensian). The ordinary position was the east side of the cloister, as in fourteen abbeys of France mentioned by M. de

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* Fosbrooke, Brit. Mon., ch. xxxvi.; Ducange, ii. 150; Lenoir, ii. 320; De Caumont, Abec., 34.

† Fosbrooke, Brit. Mon. ch. xxxvii., xlv.; Ducange, ii. 928; Lenoir, ii. 360; De Caumont, Abec., 38.

Caumont; but it was built on the west at Durham, Chester, Worcester, Shrewsbury, Lacock, and St. Alban's, by Benedictines; at Fountains, Kirkstall, and Rievalle, by Cistercians; at Hexham and Thornton (Proc. Ass. Soc., ii. 149; Arch. Jour., ii. 357), by Austin Canons; at Leiston and Eastby (where it is of two alleys, and detached) by Præmonstratensians. At Thorouet and Senauques it is over the east walk of the cloister. It occupied at Crowland the east side of a second court, in which the refectory was to the north, the granaries being on the south-west, and the guest-house on the south. Cellarage is frequently found under the dormitory, as at Westminster, Durham, and Sherborne, St. Mary's, York, Finchale and Shrewsbury (Benedictine), Bromholme (Clugniac), White Friars, Coventry, Thornton and Bolton (Austin Canons), Kirkstall, Rievalle, and Furness (Cistercian). One portion of this substructure was the *calefactory*, a chamber warmed with a stove or long heating-pipes, serving as a place to provide fire for the censers, and warmth to the monks in cold weather; the chapter occasionally met here. There were two at St. Gall, one for the brethren, and a second for the sick and novices. The dormitory stood over the south aisle at Wenlock and Wymondham. Twelve monks slept in the roodloft at St. Alban's, as watchers. The beds were ranged along the walls under the windows: the abbot, by the Benedictine (r. xxii.), Clugniac, and Austin Canons' rule, slept in the centre of the room. The cellarer then only had a separate chamber; but in later times the abbot or prior possessed his lodge, and the dortor was subdivided into separate cells, with doors made three-parts of trellis-work, so that the chief official could exercise a supervision of the whole. This plan was advantageous for silence, retreat, and devotion; and it is found in 1370 at Noyon, and, a century earlier, in the Black Friars, at Gloucester (Gent. Mag. 1860, p. 340), where the cells had stone partitions. A lamp burned all night in the dortor. At Tykford (Monasticon, v. 206) there were five cells. The dormitory of the conversi remains at Wenlock (Clugniac), (Potter's Mon. Rem.).

The chamberlain had charge of all the beds and furniture in a convent. The monks took their meridian (Monast., ii. 230) and changed their shoes before and after prayers in the dortor by day; in cold weather, when the spring in the cloister was frozen, they used hot water in the dormitory; an additional reason for building the calefactory at no great distance from it.

The *Refectory** ordinarily occupied the south side of the cloister, for reasons already assigned. At Sherborne, an exceptional case, it is to the west. Of course, where the cloister was on the north of the church, the refectory was on the north, but still almost invariably fronting the church, with Præmonstratensians, Benedictines, Cistercians, Clugniacs, and Austin Canons. The other deviations from the rule are at St. Augustine's, Canterbury, where it was on the east; at Jorevalle (Cistercian) ou the south-east, beyond the dormitory; and on the west in the Black Friars, Gloucester. In the House of the Bernardines at Paris, at Netley, Furness, and in the Marvel of Mont St. Michel, and apparently at La Luzerne, the refectory was below the dormitory. It was above a cellarage at Dunfermline, Battle, Reading, Beauport, Sherborne (Benedictine), Eastby and Leiston (Præmonstratensian), and Kirkstall (Cistercian). At Clairvaux, Savigny, and Bonport, at Tynemouth, Fountains, Vaux de Sernay, Beaulieu, and Rievalle, it stood north and south, at right angles to the cloister. The wall pulpits, which fronted the guest table, remain at Chester, Eastby, Beaulieu, Shrewsbury, and St. Martin des Champs, and were used by the reader of holy books during dinner. At Winchester College to this day the Gospel is read at election dinner. The pulpit of St. Laura, Mount Athos, is of wood. The refectory of Fountains, Netley, Eastby, Villers (Schayes, iii. 40) in Belgium, and St. Martin des Champs, has two aisles; those of St. Mary's, York, the Bernardines, at Paris, of

* Fosbrooke, Brit. Mon., ch. xxxv.; Ducange, v. 650; Lenoir, ii. 241, 328, 340; De Caumont, Abec., 41, 84.

the fourteenth century, and of Alcobaça, have three. Mural paintings enriched the refectory, as at Villers, Clugny, Fontenelle, Luxueil, St. Germain de Flaix, St. Michael, Antwerp, and St. Martin's, Dover. Leonardo da Vinci painted his "Last Supper" for the refectory of St. Dominic, at Milan. Adjoining the refectory was the toregma, or dresser, for cups, plates, &c. In the ninth century the refectory was sometimes apsidal; and the early form of the Eastern refectory, and those of Parenzo, with three apses; and St. John Lateran, built by Pope Leo III., was an imitation of the Roman triclinium. (Lenoir, ii. 329). At St. Laura, Mount Athos, the refectory is in the shape of a Greek cross.

There were four kinds of refectory:—1. The summer. 2. The winter (as at Villers and St. Bertin's, St. Omer). 3. That of conversation; and 4. The misericord, for eating flesh meat (Fosbrooke, Brit. Mon., ch. xlv., xlviii.; Ducange, s. v.; Monasticon, v. 206). At Tynemouth, we find a common hall on the west, and the new hall on the south of the cloister (Monast., iii. 311).

The *Kitchen** was, of course, an indispensable adjunct of the refectory, and invariably adjoined it, although, as at Durham, it occasionally stood behind it: its ordinary position was on the side. There were two—one for the convent, and a second for the infirmary. Our statements refer to the former. That of Marmontier was shaped like a bottle; those of St. Florence Vendome, Saumur, Villers, and St. Pierre de Chartres (thirteenth century) were round; those of Pontlevoy, Fontevrault, Durham, and Glastonbury, were octagonal; and those of St. Ouen at Rouen, St. Gall, and Fountains, square. The kitchener took charge of the butchery and fishponds; and the hebdomadarius presided over the kitchen, catering for a week, each monk taking his course in turn. The kitchen of Fontevrault had small apses in each face.

The *Lavatory* is found in the thirteenth century near the refectory of the Génovéfins at Paris and at Clairvaux, and in the south cloister walk at Westminster, Wells, Chester, and Gloucester; at Durham it was a detached building in the garth, probably built over the spring, which formed the first simple lavatory. Near the lavatory is often found a long aumbry for the towels.

The *Cellarage* usually formed the west side of the cloister, and sometimes joined the guest-house. A magnificent substructure of two aisles remains at Vincellottes, Fountains, and at Beaulieu: the cellars included granaries, beer, wine, and oil vats. On this side were the guest-house at five French abbeys mentioned by M. de Caumont, and magazines at seven others, also described by the same distinguished author. They were usually vaulted and divided into aisles: a good specimen remains, but on the east side of the cloister extending southward, of the time of Edward the Confessor, at Westminster; inferior, however, to the grand buildings of Vauclair and Eberbach. The same purpose was served by the large granges, buildings divided into three aisles, as at Ardennes, Maubisson, and St. Vigor, for the convenience of having one alley free for the passage of carts.

The *Treasury*,† sometimes called also the revestry, was generally near, or, as at Westminster, below the dormitory; sometimes near the choir, as at Canterbury; in the transept at Chichester; and there is frequently a deep recess in a crypt, to hide the sacred plate in time of danger, as at Canterbury. At Clermont, Limoges, and Narbonne, the treasury and sacristy occupy two of the choir chapels.

The *Exchequer*‡ derived its name from the chequered cloth divided into squares, for the convenience of casting up accounts. With the offices of the chamberlain and cellarer, it ordinarily stood in the great court, adjoining the cross round which the conventual market was held.

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* De Caumont, Abec., 44; Ducange, s. v.; Coquina; Lenoir iii. 348; Viollet le Duc, iv. 461,

† Lenoir, i. iii. 204—292.

‡ Fosbrooke, Encycl. 241; Ducange, vi. 84.

The *Library** at St. Gall was over the Scriptorium and adjoined the Presbytery, and was generally placed towards the north to preserve the contents from insects. Those of Wells and the Grey Friars, London, were of considerable length. At Septuagesima an inventory was taken. It is next the slype at Finchale; south of the choir at Wimborne; over the chapter-house at Dunfermline, Eastby, and Lichfield; and in an upper room near the south transept at Westminster, and near the north transept at Hereford.

The *Scriptorium* (Lenoir, ii. 374; Fosbrooke, Brit. Mon., ch. xliv.) was usually in the cloister or adjoining the church, but in the foreign Cistercian houses in the second or inner cloister; the precentor had the charge and furnished materials to the librarii, who made new books, and the antiquarii, who copied or repaired the old books.

The *Archive* or *Muniment-room* (Lenoir, ii. 69, 375) was sometimes over the church-porch, as at Peterborough and Fontenelle; in the south-western tower at Clugny, where the north-western was the prison; in an isolated tower, as at Martin-des-Champs and Vaux de Sernay. It contained the matriculation lists, chartularies, terriers, and registers. The provost kept the key. It was occasionally built over the sacristy; it is near the south transept at Chichester, and is of large dimensions, adjoining the choir at Salisbury.

The *Parlour* (Fosbrooke, Brit. Mon., ch. xli.; Ducange, iv. 142; Lenoir, ii. 327), common or reception-room, where the monks gave directions to the servants, traded with merchants, or conversed with friends, adjoined the gate or the refectory; it was on the east of the cloister at Clairvaux, St. Mary's York, Walsingham, Beaulieu; on the north at Clugny; on the south at Fountains and Citeaux; south-east at Shrewsbury; west at Durham; north-west at Newstead. The Cistercians had three parlours; (1) for visitors; (2) for conversation; (3) for confession.

The *Abbot's* or *Prior's Lodge* is called the palace in the plan of St. Gall. Suger, in the twelfth century, and the prior of Canterbury before 1120, lived in a single lodge. In the ninth century it was a large building at Fontenelle; at Pontigny it contained four rooms; at St. Gall it consisted of a mansion, including a bed-room and solar, and servants' offices, kitchen, bath-room, and cellar. It often was provided with a chapel, as at Ely. It adjoined the church usually in Benedictine houses, was detached by Cistercians, and by the Austin Canons was connected on the west side of the cloister with the nave, generally on the south-west by a staircase, and adjoining the novices' hall, as at Haughmond, &c. It was on the south-east of the cloister at Durham, Kirkstall, Leiston, and Newstead; on the south-west at Westminster, Crowland, Hulne, and Bridlington; on the east at Shrewsbury, on the north at Sherborne, on the north-west at Tynemouth, on the south at Finchale, and north of the north transept at Eastby and Castle Acre; on the north-east at Wenlock, and of two stories.

The *Infirmary*† was among the Cistercians a large hall for exercise, with separate cells like a dormitory, as at Ourscamp, near Noyon, founded 1130. At St. Gall it contained a chapel, dormitory, refectory, and consultation room, standing to the north behind the church, and ranged round a cloister. In England it was on the east of a small cloister, and furnished with a hall and chapel at Canterbury, Westminster, and Gloucester; south-west of the nave at St. Alban's; detached on the south-west at Hulne and Shrewsbury; west of the dormitory at Durham and Worcester; south-east of the cloisters at Castle Acre and Peterborough; and on the east at Rievalle, Binham, and Bridlington.

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* Lenoir, ii. 371; Fosbrooke, Brit. Mon. ch. xliii.

† Lenoir, ii. 389; Fosbrooke, Brit Mon., ch. xxxix.

The *Guest-house** was usually near the gate. One was built at Fontenelle at the close of the seventeenth century. It was not always a detached building, and frequently formed a hall, of two alleys at Beaulieu and Fountains, with bed rooms opening off it. At St. Gall in the ninth century, it consisted of two large buildings, with every convenience and servants' rooms. At St. Alban's it was an enormous range of rooms, with stabling for three hundred horses. It was on the west side of the cloister at Fontenelle and St. Germain-des-Pres, at Newstead, Beaulieu, Eastby, and in the Norfolk Houses (Harrod's Gleanings); on the west of the great court at Durham, Finchale, and Eastby; on the north at Tynemouth and Bridlington; over the great gate at Thornton; south of the cloister at St. Alban's; south-east at St. Mary's, York; east of the chapter-house, Worcester; south of the refectory at Shrewsbury; detached southward in the great or outer close at Furness and Hulne; north-east of the cloister at Tintern; on the north, over cellarage, at St. Martin's, Dover; and parallel to the refectory at Glastonbury (Collinson's Somerset, ii. 263). The Hospice, called Salle des Gardes, remains at Caen.

There were also guest-houses for travelling religious, and the poor, and pilgrims.

The Tribunal, or Court-house, and Prisons.†—The tribunal and prison usually adjoined the great gate, as at St. Stephen's, Caen; or occupied the chamber above it, as at St. Alban's, Tewkesbury, Westminster, Malling (Mon. 118, 383), Hexham, and other abbeys. The dungeon is under a tower at St. Gabriel, Calvados; near the transept at Berne; on the south of the chapter-house at Durham; at Clugny it had neither stair, door, nor window; at St. Martin des Champs was subterranean; and at Hirschau barely permitted the prisoner to lie down.

Other Buildings.—The gate-house was sometimes provided with a chapel in the upper story. A charnel was a frequent adjunct to an abbey, with a chapel over the carnary. The novices and choristers had a separate building and inner school. Glastonbury and St. Victor, and other houses, furnished seminaries or public schools, held in the outer school, usually divided by a screen or wall, to mark distinction of rank or attainments; besides these were the almonry, surgery, dispensary, herbary, industrial buildings, and workshops, mills, stalls, and stables, barns and sheds for agricultural produce and implements; while Hulne exhibits all the features of a fortified position, and others had on the coast, as at Furness, watch-towers. Battle has a fortified gate (Lenoir, i. 77; De Caumont, Abécédaire, 178). Strong walls still remain at St. Stephen's, Caen, and St. Germain, Auxerre; and forts defended the abbeys of Montpeyraux and Condat. In the thirteenth and fourteenth centuries nearly all the French abbeys and Cathedrals, as at Alby, Beziers, and Narbonne, were fortified, owing to the continual wars (Viollet le Duc, i. 227, 262; ii. 376; Lenoir, ii. 491). At Cashel a castle forms the west end of the cathedral. Holy Cross, Bective, and Crossraguel were fortified. The almonry (Fosbrooke, Brit. Mon., ch. xlii.) of Westminster stood on the west side; the sanctuary occupied the enclosure on the north side of the abbey. The almonry gate of St. Stephen's, Caen, is detached at some distance on the north side. Charnels occurred at Steinen, Hereford, Hythe, Worcester, Norwich, St. Peter's-in-the-East, Oxford, Ripon, and Lynn (Gent. Mag. N.S., vii. 156).

In conclusion, the old distich informs us that the Franciscan loved the town, the Jesuit (the worst of architects) the great city, the Cistercian the valley, and the Benedictine the mountain. In England, the Benedictine was the citizen and most learned of monks; the Austin Canons, with their long-drawn aisles, were proverbial for their love of preaching and logic; the term, doing

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* Fosbrooke, Brit. Mon., ch. xi.; Ducange, iii. 706; De Caumont, Abec., 43, 105; Lenoir, ii. 396, 400.

† Fosbrooke, Brit. Mon., ch. xlv.; De Caumont, Abec., 115; Lenoir, ii. 430; Ducange, ii. 173, 752.

Austins, *i. e.*, disputing with Austin Friars, was long a proverbial exercise at Oxford; the Cistercian, with his secluded convent, the educator of the poor, an eminent friend of the labourer, a class which he employed in large numbers as conversi, was a recluse devoted to industrial pursuits in works and farming; the Clugniac combined the fine arts, reading, and study, with bodily labour and agriculture; while the cells of the Carthusian at Mount Grace witness to the ascetic habits of a gloomy brotherhood; the Dominican was the preacher, eager for the development of intelligence, the champion of orthodoxy, and the devotee of philosophy; the Franciscan Minor, a name betokening that all the brothers were equal by their vow of poverty, was the preacher of equality. It was a fatal error at the Reformation not to have converted their beautiful and stately houses to charitable uses, study, and prayer; but we may still glean from them all that they held of good and beneficial to humanity, agriculture, and art, and go forward ourselves with a firmer foot by retaining the lesson in our hearts; and, however widely our opinions in religion may differ from many of the tenets of those who built them, we shall do well to remember that in their sacred enclosures lie buried the enmities of many generations.

Mr. Fergusson, Fellow, proposed a vote of thanks to Mr. Walcott for his valuable and most interesting lecture, which contained enough matter for the consideration not only of one but of a dozen evenings, and to which he could add nothing himself. He thought Mr. Walcott had perhaps not sufficiently dwelt upon the respective peculiarities of the basilica and the round church. The Christian basilica was copied in form from the old Pagan basilica, and in the first instance at least applied to the same purposes, having been used more as a place of assembly than of worship. It was adopted for that purpose by the early Christian public, and it was in this place of assembly that the bishop ruled the church; the round church which is generally found in conjunction with it being the ceremonial edifice, in which baptism and all the other sacred rites of the church were performed. At a future period the two buildings, which at first were respectively the one wholly secular and the other wholly ceremonial, became amalgamated, and formed the basis of the arrangement of that wonderful creation—the Mediæval cathedral—on which design and arrangement Mr. Walcott's studies had thrown so much and so clear a light. He trusted the members would have a future opportunity of considering and studying more at leisure the immense mass of information which Mr. Walcott had so ably brought before them.

Mr. Penrose, Hon. Sec. F.C., seconded the motion. Whether Mr. Walcott's paper appeared in the transactions of the Institute, or in any other form, it could not fail to become a book of continued reference; and he would only suggest the extreme importance of accompanying it by an index both of names and subjects, which would render the valuable information it contained more readily available.

Mr. Ferrey, Fellow, joined in the vote of thanks, and called attention to a class of structures presenting one church built above another. This was the case in some churches on the Rhine, and there were several also in Russia; and it appeared to him that this peculiarity admitted of further development. In his enumeration of Galilees Mr. Walcott would, perhaps, hereafter include that of the church at Snettisham in Norfolk, which was an extraordinary specimen, and as he (Mr. Ferrey) believed, the only one attached to a parish church. Another subject might also be referred to, namely, the orientation of churches and their various déviations from a completely straight axis from east to west. This subject had been lately very much discussed in various periodicals, and was one of considerable interest. He only offered these remarks from a desire that Mr. Walcott's paper should be as complete as it could possibly be made.

Mr. Kerr, Fellow, observed that there was a tradition that the "Tomblands" at Norwich

(being a place or square near the cathedral,) was so named as having been the place where the dead were buried in the time of the Plague. He had not, until Mr. Walcott had referred to it, been aware that the western towers of churches were ever used for purposes of defence, and he considered such an object at variance with the sacred character of the edifice. He had been interested and amused to find that of all the monastic functionaries the *cellarer* should have been provided with a separate dormitory. With regard to the question of orientation Mr. Walcott did not seem to acknowledge it as a principle, although at the same time he spoke of the east, west, north, and south portions of churches, as if that principle had been general. Mr. Kerr concluded his remarks by adding his testimony to the value of Mr. Walcott's interesting paper.

Mr. J. W. Papworth, Fellow, said that the northern churches of England had licences for battlements, that some of the early Irish churches were provided with an upper story over a vaulted floor, and that several of the French abbeys and cathedrals (as at Clermont, Alby, Begiers, and Narbonne,) could have served as fortresses, all these arrangements being precautions against occasions of predatory incursions. Mr. Walcott's paper was full of valuable matter for reference. It not only required to be indexed, as Mr. Penrose had suggested, but Mr. Papworth would recommend the younger students, and even those of his own age, to use it as a common-place book to be interleaved and carefully annotated. He would venture to suggest that the explanation given by Mr. Walcott of *calefactory* might be extended and made more clear; and also that chapter and verse should be given for the various statements which had been brought forward, many of which (although familiar to Mr. Walcott) were not usually made. The paper under consideration might have been extended by notice of churches which, belonging to the congregations of later origin than those mentioned, presented peculiarities, such as those of the Bridgetines in which the upper portion was occupied by the nuns; and those of the Jesuits which bore considerable resemblance to the usual English parish churches built by Wren and his followers.

Mr. Scoles, Fellow, said that Mr. Walcott had confined his remarks to the churches built before the Reformation, otherwise there would have been several points which might have been enlarged upon. The subject was extensive enough for several evenings' discussion—the questions of orientation, and the history of the Benedictine order in connection with architecture, would each afford matter to be more fully dilated upon.

The Rev. Mackenzie E. C. Walcott said that, like Sebastian, in "Twelfth Night," the only answer he could make to the many eulogiums which had been passed upon him, was, "Thanks, thanks, and ever thanks." He would bear in mind, in preparing his paper for the press, the various suggestions which had been so kindly offered. He had not noticed the Gallilee at Snettisham Church, because his remarks had been confined to monastic establishments. Mr. Fergusson's remarks on the respective uses of the basilica, and the round church, would also have his best consideration. The double churches referred to by Mr. Ferrey were exceedingly interesting, and he hoped that gentleman, having opened the subject, would himself carry it out, as he was so well able to do. With regard to the use of the western towers of churches for the purposes of defence, he believed that the parishioners in Mediæval times were so peaceable that he only remembered the case of an *emeute* at Sherborne, where the priest, in a fit of pique, set the church on fire, and one other instance at St. Edmondsbury. Where these towers were used defensively it was against the Danes, during their frequent invasions of England, and not, as Mr. Kerr had suggested, against the parishioners themselves. He had based his remarks chiefly on two passages; one given by M. Viollet le Duc, and the other by M. Lenoir.

The separate dormitory for the cellarer was allotted to him in consideration of his office, which

was second to that of the prior himself. There had been a little chapel, called the "*Charnel*," at the entrance of the "Tombland," at Norwich, which appeared as the name of the space in the fourteenth century. In restoring the abbey at Christchurch Mr. Ferrey had discovered a "*carnary*" or crypt full of human bones, proving that our ancestors did not take up such remains, and cart them away, as was now the practice, but carefully collected and placed them in a *carnary* or crypt. He had drawn a distinction in the use of the word *calefactory*, as a place in the transept in which the censers were kindled for the incense, as at Winchester; and also as the chamber opening into the cloister, used as a sitting room by the monks, and in which they had a fire. He had anticipated Mr. Papworth's remarks by appending to his MS. copious references to authorities, although he had not read these to the meeting. With regard to orientation, his own observation, during six or seven weeks, of the churches at Caen, had shown that not any two of them were precisely in the same plane. He would, in conclusion, guard himself by saying that he had endeavoured to keep within his bounds as an archæologist, and he hoped he had never overstepped those limits or spoken as if he was an architect. He had lately been reading a book by Mr. Trébutien, the librarian of the Public Library of Caen, who quoted a passage admirably appropriate to the archæologist and the architect, as follows: "The office of religion is to raise the head of man towards his God—the office of art to sustain it. After the priest the architect is the most efficient fellow-worker of the Grace of the Lord." He (Mr. Walcott) considered this a most true and striking statement. In conclusion, he could only express his gratification on hearing the comments that had been made upon his paper; for himself he felt very much like Diomede, in the Iliad, at this moment, for he feared that he had given them only his arms of brass, and had received proof of gold in return in the observations that had been made.

The Chairman, Mr. Godwin, V.P. in putting to the meeting the vote of thanks, said that several instances might occur to members present of the actual attack upon the western towers of churches. Thus, Bow Church, London, sustained for a long time a siege when Longbeard, Lord of London, took refuge in it; and the best received theory of the origin of the Round Towers of Ireland attributed them to the defence of the churches to which they were attached. He would only add one practical observation, namely, that it appeared evident to him, throughout Mr. Walcott's remarks, that the Mediæval architects, whether Benedictines, Clugniacs, Cistercians, or whatever they might be, placed their buildings exactly where it was most convenient, and arranged their churches as best suited their wants and their rubric. If, therefore, instead of copying the *details* of the course they took, architects would now adopt the same *principle*, they would be more likely to arrive at a nineteenth century architecture than appeared likely at present.

The vote of thanks was carried by acclamation, and the meeting adjourned.

ON ACOUSTICS.

Read at the Ordinary General Meeting, December 17, 1860.

By T. Roger Smith, Associate.

The subject to which I venture to invite your attention is that of acoustics, or the science of sound; in reference (of course) to its bearing on the arrangement and construction of those buildings where the free transmission of sound is of importance. It will not, I think, be deemed necessary that I should advance any apology for the subject itself. The proper construction of buildings intended for music or public speaking is a point of vital interest to every architect, as under this category may be comprehended all the more important public works that come into our hands; and such public buildings (however excellent in other respects) cannot certainly be said to have fulfilled the design with which they were erected, unless they have been made favourable to the easy transmission of sound. A knowledge of the laws that regulate this transmission, and of the methods necessary to bring a building into conformity with those laws is then most desirable to us.

A very considerable time has elapsed since a paper on this subject was read before the Institute; and this consideration, coupled with the fact that even such books as exist on the subject are not generally known, induces me to hope that it may be possible to lay before you some already-ascertained facts of interest, but which are not so familiar as they deserve to be. I must disclaim, however, the ability to present anything new, in any other sense than the one just indicated. The subject has always occupied a share of my attention, but more as a reader than as an experimenter, and latterly, it having become my duty to search very thoroughly for all accessible information that relates to it, the difficulty of collecting scattered facts, and of obtaining even the titles of books has forced itself prominently on my notice, and this difficulty it is which has principally made me feel that an account of the books and other sources of information accessible, and a condensed exposition of the most important points to be gleaned from them, might be of use to others.

(I.) In the commencement of an inquiry into the laws governing the distribution of sound in buildings, a student would naturally seek information on the nature of sound and the laws of acoustics from treatises on physical science. Without pretending to furnish a complete list I will name as the works best worth consulting the following, and I introduce them now to avoid interrupting the main subject afterwards:—

"The Treatise on Sound," by Sir John Herschel, published in the "Encyclopædia Metropolitana," and since issued separately. This is the best work on the subject in English; but it has the drawback that it does not contain any account of the discoveries of the last thirty years, having been published in 1830. Mrs. Somerville's "Connection of the Physical Sciences." Detached papers by Professor Wheatstone.* The article "Acoustics," in the "Encyclopædia Britannica," by Sir John Herschel. Arnott's Elements of Physics." "Brewer on Sound." "The Cours de Physique" of Mons. Biot. "Cours de Physique of Pouillet." "Traité d'Acoustique," by Chladni; a standard work; also published in German. And the writings of Savart, M. Biot and others, published in the "Annales de Physiques et de Chimie," and the lectures of Savart, reported in "l'Institut." On the special subject of buildings

* Published in the "Journal of Royal Institution," and in the "Quarterly Journal of Science and Art."

we have, published in England: "Saunders on Theatres." "Wyatt on Theatres," quoted in Gwilt's Encyclopædia." Inman's "Abstract of Evidence connected with the Rebuilding of the Houses of Parliament." Rudimentary "Treatise on Acoustics of Public Buildings," published in Weale's Series. A considerable number of papers scattered through "The Builder," from 1846 to the present day, especially those read by Mr. Scott Russell, before the Royal Society and this Institute, in 1847, and a few small pamphlets and incidental notices in books on other subjects. Published abroad we have: "Lachez sur l'Optique et Acoustique des Salles de Réunion Publiques," a very practical and sensible little book. "Rhode, Theorie der Verbreitung des Schalles für Bunkunstler," a small but very valuable pamphlet. Observations by Chladni in his book and in contributions to the "Allgemeine Musikalische Zeitung;" and a few other papers and books. I am, moreover, informed that a French work of great value on this subject exists, different from any of these, but the title of which I have been unable to learn.

(II) From almost any one of the first-named books a general knowledge of acoustics can be obtained; and if we make an attempt to sum up briefly what is known about sound, leaving out, as not essential to our present purpose, both the refinements of mathematical calculation and the elegant results of experiments on undulation, vibration, the pitch of musical notes, and other departments of the science, we arrive at a few definite results of philosophical inquiry which can be briefly stated, and will be enough for the present purpose,

Sound, then, may be regarded as motion made sensible to our ears, and the sense of hearing as a very refined, sensitive and delicate sense of *touch*. A moment's thought will suffice to remind you, if this description seem at first sight startling, that there is *no* sound unaccompanied by motion, that there is but very little motion without audible sound, and lastly, that if motion exists, but be so cut off from our ears that no communication can take place, we hear no sound. Sound is not, like light, conveyed through an imponderable medium, it, on the contrary, travels through all the substances, solid, liquid, and aërform, that surround us; and it is precisely that class of substances best suited to convey motion, which furnishes the best conductors of sound, while those bodies that deaden and destroy motion deaden sound also. For example, a rod of elastic wood, or of iron, will convey readily any motion from one end of it to the other, and such a rod forms one of the best known conductors of sound. A heap of sand will, on the other hand, be it only thick enough, check the force of the most powerful cannon-ball, and, where there no means of hearing *round* it, such a heap would equally deaden the report of the cannon; unless, indeed, the air lurking between the grains of sand conveyed some faint impressions to the listener.

We are, however, more familiar with the atmosphere as the conductor of sounds which reach our ears than any other medium, and as it is through the atmosphere alone that the sounds heard in large rooms are transmitted, we shall have little occasion again to refer to the conducting properties of other media.

The atmosphere, under favourable circumstances, will transmit to great distances any agitation that is roused in it. As an instance of this we may refer to the experiments of M. Biot. This gentleman having an opportunity of operating with a very long cast-iron pipe, forming part of an aqueduct in course of construction at Paris, found that even when the pipe was 1,040 yards, or more than half-a-mile long, the explosion of a pistol fired into it at one end would blow out a candle at the other, and that the lowest whisper at one end was as distinctly audible at the other as to the speaker himself. This experiment succeeded better at night than in the day time. Although, however, the air in a tube where any lateral escape is impossible shows this marvellous sensitiveness, we do not find a similar result from speaking in open, unconfined air. It is matter of familiar experience that sound under these circumstances decays and dies away, till at last it ceases to become audible. This decay is only the

natural consequences of the fact that the original force is constantly spreading through a wider and wider space, and is getting (so to speak) diluted. A familiar illustration to you all will be the gradually widening circles that spread on the surface of smooth water from a spot where you drop in a pebble, and which, weakening as they widen, at last fairly vanish into the flat unbroken lake.

The analogy between the progress of sound and that of concentric water-waves thus roused is however, less complete than is ordinarily supposed, for it usually happens that, from the first, sounds have an *initial* direction impressed upon them, and that they travel further in this direction than in any other. The most familiar instance to us all is that of the human voice, which is always heard very much further in front of the speaker than it is at his sides or behind him. The human voice is not, however, an exceptional case; it is well to know that the larger number of sounds have something of this propensity. A good example is a tuning-fork: when the sound of this is excited it will be audible to a much greater distance square than corner-wise; that is to say, you will hear it better if the ear is in a line with the two arms, or in a line at right angles to one joining the two arms, than it will if the fork is turned a quarter round, so as to present towards the hearer an angle and not a face of one of its arms.

The decay of sound is very much prevented not only by any initial direction it may receive, but also by any accidental circumstance that prevents the agitations in the air from spreading laterally, even if it be only one side that is confined. Thus, sound will travel a long distance along the ground, and it will be very audible along a wall, because the angle formed by the wall and the ground forms two sides of a sort of tube, and thus prevents part of the lateral escape. There is an instance of this sort recorded in Dr. Hutton's Dictionary, of a garden wall existing in Dorsetshire that will, he states, convey in this way a whisper 200 feet, without loss of distinctness.

Sound in open atmosphere travels in a straight line; should it, however, encounter an obstacle, or pass the limit of any boundary, it always spreads to some extent behind that obstacle or boundary. For instance, in a church an auditor exactly behind a stone pier and close to it will probably hear worse than if nothing were between him and the clergyman; but still, even close to the pier he will hear; and, if keeping always the pier between him and the speaker, he moves further back, he will soon reach a point were he will hear as well *with his ears* as if there were no obstacle. I use the words "with his ears" advisedly, because the eyes always assist us in our attention to public speaking, and, of course, this assistance would be lost in the situation I have supposed. Sound, when it encounters an obstacle directly opposed to it is, however, beaten back or reflected, thus giving rise to a phenomenon (the phenomenon of echo) a phenomenon familiar to all, and is the result of such a reflection, sending back the sound from a considerable distance.

It was laid down by Mr. Scott Russell, in the paper read by him before you on this subject, in 1847, that in the case of sound, the movements of which are closely allied to water-waves, reflection does not take place except where the wave impinges on the obstacle at an angle greater than about thirty degrees. Where the angle is less than this the sound does not again leave the obstacle, but simply runs along the face of it—in fact, is conducted along it in the manner we have just had occasion to mention. All, or almost all, whispering galleries are examples of this conduction, that at St. Paul's being a very good one. Should the angle, however, at which the sound falls approach nearer to a right angle, it will be reflected back, and will follow the same law as the reflection of light; that is to say, the angle of reflection will equal the angle of incidence, so that all sounds, to be heard as echoes by the speaker, must fall on a reflecting surface exactly at a right angle, and if a sound reaches any surface at an angle of, say 45 or 60 degrees from the right, it will be thrown off at the same angle of 45 or 60 degrees, but to the left.

It will be familiar to all that there are some echoes that can repeat one syllable, some two, some

three, and so on, simply because, in the one case, longer time elapses than in the other before the echo gets back; and it will always be found when the sound takes longer time to make its journey to the reflector and back, it is because it has had a greater distance to go over. From this we gather that the speed at which sound travels, rapid though it be, is not so great but that the effect of even a moderate addition of length to the journey is quite perceptible in the longer time it takes for the sound to reach the ear. In this particular sound differs from light and electricity, which travel so fast, that unless over great distances, the time they consume in going cannot be detected.

The actual speed of sound in the atmosphere varies slightly with the greater or less density of the medium. It has been very frequently measured, and Herschel states, as the results of the best investigations, that sound in dry air at the temperature of 62 degrees travels over 9,000 feet in eight seconds. This statement is easily remembered, but it may be useful to add that 9,000 feet, or 3,000 yards in eight seconds, equals 1,125 feet, or 375 yards in one second, or $12\frac{3}{4}$ miles in a minute. As a practical application of this fact, I may extract from the same author the remark, that if music were performed in a room fifty-three feet long, with an echo in the extremity, each reflected note, should there happen to be a passage with as many as ten notes in a second, would exactly interfere with the following note sounded by the musician. Passages as rapidly as this constantly occur in modern music, and it is not a very uncommon thing to hear them thus spoiled.

The varieties in the nature of sounds are very great. Thus we have music, articulate speech, and noise; we have variations of pitch, of quality, of loudness, of volume, of intensity, and of distinctness. We have in music combinations of sounds in succession to form melody, and of sounds heard together, we have some combinations that are harmonious, and some that are discordant. As an illustration of some of these peculiarities, let us suppose the string of a harp struck and left to sound. We hear a long definite note gradually dying away, but which, faint though it becomes, still retains its pitch. If, now, we examine the harp-string, we find it constantly vibrating too and fro with great rapidity; as it gets to rest its excursions on each side of the line of repose grow shorter and shorter, but they neither become more nor less frequent than when they were most violent. It is clear that each movement of the string must rouse a movement in the air, in fact, strike a blow upon it; and we begin now to trace some connection as likely to exist between the regular recurrence of these blows and the equable pitch of the note the string gives out, and also between their diminishing vigour and the fading loudness of the sound. It is, in fact, as I dare say you all know, the regular recurrence of distinct impressions which occasions all prolonged sounds, and, with one or two exceptions, this is always a consequence of vibrations. The way in which the separate shocks on the ear produced by the vibrations get fused into one sound corresponds very closely to what happens to the sight when a spark of fire is swung round so rapidly as to appear a fiery circle: the impression of the sound on the ear, like that of the spark on the eye, does not die away the very instant the exciting cause stops; and if that impression be renewed before the recollection of it has had time to vanish, the sense of hearing loses the consciousness that any intermission has taken place.

Very bright lights remain longer impressed on the eye than the image of ordinary objects, and, similarly, very intense sounds remain longer in the ear, and consequently fewer repetitions of them in a second are required to produce a continuous note; so that though it is impossible to hear sounds from an ordinary cord making fewer than 30 vibrations* in a second; yet Savart has succeeded in making

* Some confusion has arisen from uncertainty as to the exact meaning of 'a vibration;' some writers having held the term to signify one excursion of a string from its position of rest to the greatest limit of disturbance and back, while others consider a vibration to include two excursions, one on each side of the position of rest; this is the meaning usually given to a vibration by the best writers, and consequently one complete vibration includes two pulses striking the air in opposite directions.

audible a sound composed of only 14 pulses, or 7 complete vibrations, in a second; and, at the other extremity of the scale, in rendering audible sounds up to 24,000 vibrations, or 48,000 pulses, per second. The greater or less frequency of the vibrations occasions the sound to be more less sharp, and the actual correspondence between the number of vibrations in two notes determines their concord or discord when sounded together. For example, the lowest C on a grand piano is said by Brewer* to require 32 vibrations in a second for its productions; the sound most accordant with that is its *octave*, the number of whose vibrations always bears the relations of two to one to those of the original sound. Thus, in the instance just selected, 64 vibrations in a second are required to produce the C an octave above the one we started from. If the dots in the diagram represent pulses, it will be seen that when a note and its octave are sounded together, every vibration of the fundamental note coincides with a vibration of the higher one. If G, the fifth above this C, had been substituted for the octave, we should have struck a note containing 48 pulses in a second along with the C containing 32 such pulses; that is to say, three pulsations of the higher note to every two of the lower one; and, as the diagram shows, only every other pulse of the fundamental note would have coincided with one of the upper one. This is the next most accordant interval. The relation between a note and its major third is expressed by that of 4 to 5, or 32 to 40, so that this interval is less perfectly consonant. Two notes, the pulses of which hardly ever coincide, sounded together, produce a discord. For instance, the seventh above any note bears the relation to it of 15 to 8, and this is consequently a very imperfectly consonant interval.

Beyond just stating that all natural sustained sounds are produced by the vibrations of elastic substances, it is impossible to enter upon the very complicated and very interesting investigations that Chladni, Savart, Wheatstone, and others have conducted upon undulation and vibration in all its forms, or to deseribe to you the elegant experiments by which the motions of vibrating bodies are rendered visible. The transmission of these vibrations through the air is, however, a matter of some moment to our subject. Each impulse of the vibrating body makes an impression on the air immediately adjoining it, which impression instantly passes onwards and outwards, leaving the atmosphere behind in a state of quiescence. A wave of sound is, in fact, a state of momentary compression travelling with the speed of the wind away from its exciting cause into space; and it is accompanied by a displacement of particles, slight indeed, but still actual, and, in fact, when the impulse has lost the power of moving the air at all it ceases to exist. Should this wave meet with an obstacle that reflects it, it will travel back through the atmosphere to any point to which it may be directed by the reflecting body. Any agitation of the air, which from circumstances, such as reflection, for example, is made to take the form of regular pulses, will, if these are but frequent enough, become an audible sound; and this fact affords a basis upon which to rest an explanation of the process by which the air, which previously only *transmits* sound, becomes itself a sonorous body of the utmost importance, a process constantly going on in the human voice, in organ pipes, wind instruments, &c., and also unintentionally promoted by the shape and arrangement of many buildings. Take a familiar instance. Suppose that we have a pipe, of any length shorter than about thirty-five feet, closed at one end, and make an agitation in the air at the open end. As long as the separate movements are so far apart that the impulses leave long intervals between them, no sound is heard; but as soon as the movement is brisk enough for a pulse the moment it has travelled to the bottom of the pipe and back, to be followed at once by another, an audible sound will result, the pitch of which depends on the length of the journey each pulse has to make down the pipe and back again. If we go on making the agitation more brisk

* Whose numbers do not precisely correspond with those given by some of the French writers.

for a time, no alteration, except in loudness, will be audible, the pipe seeming, so to speak, to keep the agitation that wants to enter it waiting till the one that is there emerges. But suddenly the sound will jump an octave, and we shall find, if we take the proper means of investigating, that the air in the pipe has divided itself into two vibrating lengths. Increase the agitation and soon another jump takes place, the air in the tube dividing itself into three portions and so on—the points of division being termed nodes. Thus, for example, by blowing more or less violently into an organ-pipe, we can produce either its fundamental note, or the octave above that note, which is the sound proper to a pipe of half the length, or to the original pipe divided into two portions by one node, or the twelfth above, which is the sound proper to a pipe one-third the length; or to the original pipe divided into three portions by two nodes, and so on. These divisions equally occur in vibrating strings, and it is remarkable that even where a string or a pipe is sounding the gravest note it can emit, a second set of vibrations almost invariably coexists along with the primary ones, giving out the octave, twelfth, &c. These sounds are called *harmonies* of the principle sound, and an acute ear can detect their presence constantly; perhaps nowhere so readily as in the note of a large bell.

It becomes of importance to us to know all these circumstances, if we reflect that any room may be regarded as nothing else than a great organ-pipe, in which, if a suitable agitation be roused, sounds, no doubt, will be emitted by the air. Nor is there any safeguard in the size of the room; for although a room be too large for what would be its primary note to be audible, the harmonies of that note, some of them, will be quite appreciable; and it is the presence of these that causes what is known as the *note* proper to a room. As this note cannot be ordinarily avoided, the only thing to be done in relation to it, is to see that the dimensions of the room, each way, bear some simple numerical relation to one another: so that if undulations are roused that travel from end to end, and others that travel from side to side, the sounds due to the two may blend harmoniously, and not clash discordantly.

The last point to which I have to draw your attention is the sympathetic vibrations that sounds can excite in sonorous bodies. If a tuning-fork is sounded in the air its note is extremely feeble, but if it be rested on a pianoforte, or a table, a marked alteration in sound is audible. Half-a-dozen tuning-forks, of different pitch, tried in succession, will all rouse the same phenomenon, and the truth is, that small as they are, each one has set the entire material of the pianoforte or the table in vibration, and that, too, in accordance with its own rate of motion, so that the whole table or the whole piano has become, for the moment, a part of the tuning-fork, and is emitting sound in unison with it. If we now vary the experiment, and hold our different tuning-forks near the open end of an organ-pipe or a flute, we shall not get the same uniform result. Those forks which emit the sound the pipe or flute would emit if blown into, or one of its harmonies, will be found to set the air in the tube into sonorous agitation, and the note they emit will be greatly reinforced; but the other tuning-forks, whose note is not related to that of the pipe in question, will be found to have only a trifling influence, if any, over the air in the tube, and this sound will not be perceptibly reinforced.

Thus we arrive at a fact of the greatest importance, namely, that some vibratory bodies will move in unison with almost any sound, while others voiced to emit a particular note, will reinforce that note, or those related to it, but will be useless, or almost useless, as regards other notes.

(III.) It now becomes desirable, having considered some points relating to the nature of sound and its transmission, to ask, what means have we of influencing sound in a building?

There are two familiar instruments in every-day use, and a third, some forms of which are also well known, which supply a sufficient answer almost without words to the question, "What means have we of influencing sound in a building?" The two instruments I first alluded to are the violin and speaking-trumpet. The third is any common reflector, say the sounding-board of a pulpit. If we take any

familiar sounding object, such as, for instance, a watch, and note how far its beat can be heard in a room, and then place it successively in the mouthpiece of a speaking-trumpet, in the focus of a parabolic reflector, or against the body of a violin, we shall find that in each case we have influenced the sound; and so far as I know, we have no possible means of influencing the sounds emitted in buildings, except such as bear an analogy to one of these three.

There will be something to be said by-and-by about impediments, and the avoidance of them; for, after all, except in extraordinary cases, the main secret of success in building, for sound, lies in simply doing as little harm as possible; but as far as assistance to sound goes, I repeat, we cannot get beyond the teaching of the mirror, the speaking-trumpet, or the violin.

To return to the watch, we shall find that both the reflector and the speaking-trumpet cause its tick to be heard much more loudly at the same distance, or to be audible to a much greater distance than when uninfluenced; but only in one direction. The person to whom the trumpet is pointed, or towards whom the mirror faces, gets more sound; but a person at the side gets less. Were the sound of such a nature as to be capable of being closely examined, it would be found in both cases to be deteriorated in quality of tone, and I am inclined to think more so by the reflector than by the speaking-trumpet, and in each case, if articulate, or otherwise very sharp and defined, it will have lost a little of its distinctness. If, now, we take the violin and place upon it the watch, we shall find that the sound will be audible to a greater distance than when the watch is by itself; but will not be (as in the other cases) confined to one direction only. It will not, probably, extend in any direction so far as the trumpet would throw it, but will be much more equably heard, while—and this is the great point—whatever change takes place in its character, is entirely for the better. None of its distinctness is lost, but its tone is improved; and should the violin be a very fine one, and something with musical sounds be substituted for a watch, the effect on the quality of the sound will be very marked. A string, for example, stretched to sound a certain note, and excited by a violin bow, will give out its proper note, indeed, but its voice will be poor, thin, and weak. Transfer the string to the instrument, draw the same bow across it in the same way, and the note of the string, re-inforced by the vibrations of the body of the instrument, will be something totally different, incomparably finer, and yet identical in pitch and sharpness.

We ought, then, in building for sound, to take a lesson from each of these instruments. What are their peculiarities? In the reflector and speaking trumpet the influence upon sound is almost wholly a matter of form. In the violin it is also no doubt a matter of form, but as much, if not more, a matter of materials combined with form. We gather, then, that we may, as in the speaking trumpet, impress an initial direction on sound as emitted, and guide it forward, or that we may aid its progress by reflectors behind or above the speaker, but that if we want to support or improve it, we must have recourse to the resonance, or sympathetic vibrations of some sonorous body, capable of lending itself to all the varieties of sound produced near it. The common sounding board often fixed over pulpits acts as a reflector, but usually (being made of thin wood) as a resonant reflector, a much less dangerous neighbour than a hard smooth surface of plaster or stone, which has the disadvantage that it reflects a sharp and somewhat spoiled echo, which travels in the same direction, indeed, as the primary sound, but is a little behind it, and seems often to mar its distinctness. It will be readily understood that a slanting reflector overhead, to beat downward and forward rays of sound that would otherwise escape towards the ceiling and be lost, is likely always to do good, and can in no case be so injurious as one behind the speaker; and it need scarcely, I think, be added that the only reflectors that *can* be of advantage are those that throw the sound forwards in the same direction as that in which the speaker is speaking. An echo reflected down from a high ceiling, or worst of all, back from an opposite wall, will always be disagreeable.

It may be more appropriate here than afterwards, to notice a curious application of the reflector to pulpits, which was some years ago rather extensively made use of, and may be termed Mr. Blackburn's Parabolic Reflector. It appears from a pamphlet published by Rivington in 1829, entitled "Description of a Parabolic Sounding Board erected in Attercliff Church, by the Rev. John Blackburn," that this church is a parallelogram, 95 feet by 72, and 56 feet high, with an elliptical recess 32 feet wide by 10 deep for chancel, and the pulpit placed in the centre of the centre aisle, in front of the chancel. There is no clerestory, but there are pillars supporting a gallery. In this church it was impossible for the preacher to make himself heard, and after shifting about the pulpit in various directions with no marked advantage, he determined to erect behind the pulpit a sounding board like a hood—parabolic in section, with his head in about the focus of the parabola. He relied upon the property of that curve to reflect as parallel a series of rays diverging from the focus, and he adds, that the result exceeded his most sanguine expectations. The congregation were now able to hear the preacher, and the remote seats of the church became some of the best. The inventor of this expedient was Mr. Blackburn himself, and he brought it before the public in this pamphlet, which is admirably and scientifically written, and also laid it before the Royal Society and the Society of Arts. With the last-named Society he deposited a model, which has since passed into the possession of the London University College, and it is by the courtesy of the secretary of that college, and of Professor Potter, that this model, which is the one before you, is intrusted to me for this evening's paper.

To proceed, however. In the Society of Arts Transactions I find two letters from Mr. Farish, the Jacksonian Professor at Cambridge, who had had one of these reflectors put up in his church. He reports most favourably both upon Mr. Blackburn's reflector and his own, saying that the sound is improved in every part of the church, and especially that of the more distant parts; *but* he alludes casually to inconveniences that had been supposed to exist, and says they are of no consequence. This seemed like a flaw in the case, aud as the point appeared of great practical interest, I obtained, through the kindness of Mr. Holland, of Sheffield, full particulars of the subsequent history of the reflectors, and, not to trouble you with all the details, found the main facts relating to them to be these.

First, I find that the reflector has been pulled down from Attercliff Church, partly because it was unsightly, partly because the present incumbent can do without it, and partly because the inconveniences attending it were felt very trying by most preachers: for although the inventor either was not annoyed by them, or endured them cheerfully for the sake of the real benefit he derived from the reflector; some of the casual occupants of the pulpit found it so trying that they used to prefer preaching from the reading-desk. The disadvantages were,—first, that the speaker heard every word uttered in every part of the church; secondly, what was worse, had every word he himself uttered dinned into his own ears; and, lastly, that to do any good with the reflector he was obliged to keep still, with his head in or near the focus of the parabola. One of the neighbouring clergy preaching in the Cambridge Church states that he was at once amazed and amused at the distinctness with which he heard the whisperings of the charity children in the remotest part of the west gallery; and the converse of this transmission was perceptible, for the tick of a watch placed at the focus of the parabola could be heard to the very end of the church.

As regards the general application of these instruments, I find that the carpenter, who made the original one, himself made and fixed no fewer than twenty-nine of them, including two at Oxford, one at Cambridge, one at Trinity Church, Huddersfield; one at Duckenfield, near Manchester; and one at St. Sepulchre's Church, Smithfield;—perhaps members present can inform us of the fate of some of these. Also, I find that at Darnall, near Attercliff, the end of the church was built in a parabolic

shape, and the pulpit fixed in the focus. The preacher in this church is satisfied with the effect, but occasional preachers, some of them, dislike it. Lastly, I got information of one other church at Sheffield, where the reflector was put up and made use of, and satisfied the clergyman and those persons who sat in the centre and at the ends of the church, but the people at the sides heard worse than before, and complained accordingly, so much so that it had to be removed. The clergyman in this last instance expressed the opinion, that the reflector was probably likely to be more certainly advantageous the longer the church in proportion to its width, an opinion in which I quite agree with him.

From these facts, which I hope I have not unduly extended, we may gather that the parabolic reflector possesses such disadvantages that it would never be safe to build the end of a room of that shape, and that, in most instances, it will be inadmissible, even as a palliative, in bad cases; but that, on the other hand, it does enable persons remote from the speaker to hear well, and therefore, in a church or room that was long and not wide, it might be valuable, if the speaker is not nervous, and does not employ much action. I need not add that it can hardly fail to be always frightfully ugly.

We pass now to consider the speaking-trumpet, and the analogy it may bear to a room. The action of the speaking-trumpet was for long attempted to be explained by the theory that the sounds were reflected across and across from side to side of the tube, and somehow got ejected from its mouth nearly or quite parallel in direction. But this theory fails in many ways to account for the phenomena of the speaking-trumpet, and M. Hassenfratz, the great authority on that instrument, declares that all his experiments led him to the conclusion that the effects on sound produced by the speaking-trumpet are due to a different cause. The air contained in the interior of the instrument, he maintains, being enclosed by its walls, is compressed by the vibrations of the sonorous body in a more vigorous manner than would be the case if the walls had no resistance; consequently, each individual particle of this air obtains a greater amplitude of vibration, and is capable of transmitting that action to a greater distance before it becomes entirely lost, than it would in the open air. Now all this applies *mutatis mutandis*, to a public speaker in a room. If you set him up in a spot where a great height over his head swallows up the sound above him, and vast spaces open on either side of him and behind him, the power of his voice is wasted in communicating vibratory motion to these masses of air, as well as to that mass which lies in the direction where the auditors are. If, on the other hand, avoiding the extreme of cramping and confining the space too much, you set your speaker under a low roof, which rises as it goes away from him, and in a recess that widens as it joins the main building, you procure him the advantages of the speaking-trumpet, and throw his voice forward by preventing it from losing itself. And it must further be remarked that if you want your speaker to be able to address a very numerous audience indeed, you must effect it, not by enlarging the building very greatly in every dimension, but by extending it in the direction towards which speech is directed—namely, forwards—with only such additions of height and breadth as are necessary to prevent the structure from failing through disproportion.

Turning now to the violin, we find its peculiar effects are due to resonance. Several methods exist of procuring resonance. We have seen that a body of air in a room will reciprocate certain sounds, and we find in certain buildings that the air will reciprocate any musical sounds emitted, but with the disadvantage that it continues to sound them for some time after the original musical notes have ceased. Canterbury Cathedral is the finest instance of this sort of resonance I have heard of. Westminster shows it also. Beautiful as is the blending of sounds and richness of tone due to this cause, it is of more advantage to church music than to reading or speaking, as you will readily notice at Westminster. In ordinary public buildings, therefore, a large mass of empty space is to be avoided, not only because the air in it absorbs part of the power of the voice, but because it may be resonant in an undesirable way. The

employment of thin planks of wood for procuring resonance is not open to the same objection, and nearly all the most celebrated acoustic buildings known will have been found to be fitted up to a great extent with wooden lining. A floor on columns, with a hollow space under it, and a ceiling with a hollow space above it, are both adjuncts to resonance. It is to be remarked, that the presence of auditors in a room deadens the sound so much that if a building be such as to afford, when full, the greatest available assistance to music and to the human voice, it is more than likely to have a very decided reverberation when empty.

IV. Let us now for a moment ask what *harm* we can do to sound; what impediments a building may present to its propagation; and how far, in a new building, we may avoid those impediments, or, in one where they already exist, may neutralize or remove them.

The principal causes that will have an unfavourable influence on sound in buildings, are echo, reverberation, obstacles, and unshapeliness or bad proportions. Echo is, where it exists, one of the most formidable blemishes possible in a room, for it asserts its unwelcome presence with every word that is spoken. The presence of a flat surface at a considerable distance from the speaker or musician, and facing him, is very much to be avoided, as apt to echo, and consequently in almost all good public rooms the end farthest from the platform is curved, or recessed, or otherwise broken up, or has a gallery thrown across it, the front of that gallery being carefully arranged, so that either it shall not echo or shall reflect the sound to where there is no auditory. In case of an existing echo, the best remedy no doubt is to break up the surface of the reflecting wall in some such way as this. Where expense or other difficulties render this remedy inapplicable, hanging up draperies, which may mask and break up the offending surface, will do good. In over-lofty rooms an echo is often perceived from the ceiling downwards. Such a one exists very decidedly in the new reading-room at the British Museum. Should the echo, however, be indistinct, or very much broken up, or should there, indeed, be a noise, but not amounting to a regular echo, the disturbance is called reverberation. The excess of resonance in an empty room often causes reverberation, and may be generally cured by covering those surfaces which reflect sound with soft substances. The audience frequently subdue it, but if not, the gradual addition of carpets or matting, or hanging up drapery, will proportionally deaden the excess of sonority in the room till a proper pitch of distinctness is gained. In a church in the north, where the reverberation was unpleasant, even when there was a full congregation, the desired quiet was, I am told, quite gained by so small an addition to the amount of non-reflecting surface as was afforded by laying down matting over the aisles and other open spaces. Open skylights are very apt to reverberate, so are deep and square window recesses, and both ought to be avoided where sound is of great importance. Lastly, damp walls reverberate much more than dry ones, and in a new building it may often be as well to hang up a little drapery for a few months, which can be safely taken down when all gets quite dry.

The next unfavourable agency was that of obstacles. Sometimes in buildings of some size obstacles in the shape of columns, not only may be tolerated, but will bring beneficial results after them on account of the good they do in breaking up or cutting off vacant spaces. This is particularly the case with the columns in churches, which, obstacles though they may be to direct sight and hearing, often help to prevent reverberation, and always are essential to that system of construction with a nave and side aisles, which is not only ennobled by ancient tradition, but also found to suit well with modern requirements. The most serious obstacle to comfort in hearing is the interference of some one's head between the auditor and the speaker. Where the speaker is not very high up indeed, and the audience occupy a level floor of any great extent, the inconvenience from this cause is much felt, and some partial elevation of the back of such a floor is often attempted.

A method of securing an undisturbed ray of sound and line of sight for each auditor was first

published by Mr. Scott Russell in the "Edinburgh New Philosophic Journal," vol. xxvii., for 1839, and has since been re-described and illustrated by Lachez, though it appears to have been practised more or less perfectly by the Romans. It consists in a system for setting out the height of the seats, by which they fall into a curve, called by Mr. Scott Russell the is-acoustic, or equal-hearing curve. The mode of procedure is as follows:—Having a section of the room, and having determined the position of the speaker and the seats, you proceed to determine the height at which you will place the speaker above the first auditor. This settled, draw a line from the speaker's mouth, and let it touch the point where the top of the head of the first auditor ought to be. This will fall on the line marking the position of the second auditor, and you fix the height for his seat, so that this visual line will come below his eye or ear—for this allowing some average dimension. From the point of intersection thus obtained, set up a height which will give the top of the head of this second auditor, and so on. The dimensions that Lachez advises to be followed are:—

	m.	m.		ft.	in.	ft.	in.
Back to back of seats	0·60 to	0·75	*i.e.*	1	$11\frac{1}{2}$ to	2	$5\frac{1}{2}$
Height of seat	0·45		*i.e.*	1	$5\frac{3}{4}$		
Mean height from top of seat to eye .	0·75		*i.e.*	2	$5\frac{1}{2}$		
Mean height from point of intersection to top of head not less than . . .	0·15		*i.e.*	0	$5\frac{9}{10}$ to	0	6
Better as much as	0·30			0	12		

Mr. Scott Russell, however, recommends for face-room, or the height from the mark for the point of intersection of the visual line with the perpendiculars to the top of the head, an allowance of 18 inches. The nearer to the front seat the object to be seen or person to be heard is placed, and the lower it is, the more steep will be the inclination of the seats. The further removed and the higher elevated the object is, the less steep will be the curve which, in such cases, even dips down to the commencement of its course. The seats in the Handel orchestra at the Crystal Palace will give a good idea of the nature of this is-acoustic curve. There is a great advantage besides the direct radiation of sound to auditors thus placed, and it is, that they are almost of necessity free from the effects of echo. To make a stepped arrangement of seats perfect, they should be arranged on a sweep on plan, and then every auditor will have his face directed towards the speaker—will have an uninterrupted sight and hearing, and will be free from echo at his back; for if any such echo exists, it *must* pass over the heads of every one but those in the very back row of all.

The remaining obstacle is unshapeliness and bad proportion. That a disproportionate room is bad for sound is a fact long since admitted, and holds good whether that room be large or small; but when this has been said, and experience has been appealed to for confirmation of the fact, there is very little that, in the present imperfect state of architectural acoustics, can be added. The subject has been alluded to before, and the most probable explanation of what is an admitted truth was then given, namely—that if all the dimensions are not in proportion to one another, the note of the room will not be good and pure. It is very possible that, in time, we shall know this for certain, and shall know, too, what precise series of numbers are best for dimensions, so that a room may be "voiced" beforehand, like a bell or an organ-pipe, by calculation. But we have not reached such knowledge yet.

In connection with proportion, however, I ought to draw your attention to the great division which seems to obtain between buildings for sound. There are, no doubt, two main divisions of speaking places. In the one (of which an ancient theatre is a type), sound is directly radiated from the speaker to the hearer much as in the open air. This should approach a circular or semi-circular shape, and an equal dimension in every way. The second sort is of those where the form of the building combines with the

initial direction of the sound, or imparts such a direction to it, and conducts it onward in one direction. The majority of large rooms are of this class. Probably, therefore, one or other set of forms and proportions always ought to prevail. If the building is to be on the radiating principle, it must be constructed so as to avoid reflection of sounds, and may be lofty, but must approach a semicircle or a circle on plan. If conduction is to assist, then there must be one dimension decidedly predominating over the others, and that dimension should be the length away from the speaker, and should regulate the width and height; with the proviso, that in these buildings the proportions should be rather long than short, and rather low than high.

With one example of an influence upon sound in galleries and long rooms, which is unquestionably due to the proportions of the room, and will be modified by every modification of those proportions, we shall have done with the topic. It must have often occurred to persons listening to music in a tolerably long hall or gallery, to notice that there are portions where the sound appears more distinct than in others. This variation was very noticeable in the Floral Hall at the time concerts were given there, and may, I understand, be observed in St. James's Hall, though I have not been able myself to detect it. This phenomenon coincides with an interesting investigation of Savart, published by him in the *Annales de Chimie*. He invented an apparatus for showing visibly the actual condition of the air in a room during the time that a continuous sound of great intensity was kept up; and I mention this investigation, not as having been pushed so far by him as to lead to any practical result, but rather as showing that methods exist by which we may perhaps be able to arrive at information as to the acoustic condition of the air in rooms, to a degree hitherto unattempted. The sound employed in this investigation was that of a bell fixed in front of an open cylinder of such dimensions as to be suitable to reinforce powerfully the note of the bell; and a sound was obtained by this apparatus of such intensity as to be hardly bearable. The effects of this sound on the air were made visible by a sort of artificial ear, formed of a thin membrane stretched tightly over a small wooden frame, and lightly sprinkled with sand. This membrane, when near the bell, became excited, so that the sand on its surface was thrown into an agitation, but on moving it to and fro along the room, places were found where the agitation varied: in some parts it became very intense, in others very moderate, and on exploring every part of the room, it was established that the points of greatest intensity formed a spiral line, making several revolutions during the length of the apartment. On opening an end window, this spiral could be traced as continued into the air beyond for a considerable distance. The distance from one turn of this spiral to another was in no case equal to the length of the undulation proper to the note sounded, but it became greater the larger the apartment, and in a long gallery approached the length of the sound-wave. When windows in the chamber were opened, the position of this line of loudest sound, which, by-the-bye, was distinctly perceptible to the ear, as well as visibly demonstrated by the moving sand, was altered, but moving about the sounding apparatus from one part of the apartment to another did not cause any such alteration, which seems to show that this property of a room, if once decidedly manifested, cannot be altered by moving the position of the speaker, but will only be affected by changes in the room itself.

V. We have now got together some few materials for the design of an acoustic building. Let us for a little consider how they have been applied, or can be applied to various descriptions of structure, commencing with an inquiry how far the simple consideration of size ought to modify the treatment.

The safe limit of direct radiation can, of course, only be very approximately ascertained, but comparing the results obtained by Saunders's experiments, with the observations of that accomplished philosopher as well as architect, Sir Christopher Wren, we may say approximately, that if we were to enclose a space not exceeding 70 feet in length by a somewhat smaller breadth, we should be quite safe

in presuming that the natural radiation of a human voice of ordinary power would reach all the audience with no assistance, when the speaker was placed in the best position for being well heard, provided always we were able to insure that no echo from any part of the walls should interrupt. Should our building be much larger than this size it will become desirable to assist, if practicable, the voice of the speaker. If we apprehend a considerable interference of any obstacle with the sound, this may be too great a dimension to be safe. If, on the other hand, circumstances are all favourable, it may, undoubtedly, be exceeded.

The conditions under which a single speaker can best address an auditory depending upon direct radiation, have been already referred to. The building should have a circular outline, and be in extent something more than a semicircle. The seats should rise one above another, the speaker should be pretty well forward among his auditors, and the remotest auditor should not be beyond the limits of direct radiation. The most perfect type of these buildings, seems to have been an ancient Greek theatre; especially if we bear in mind that the chorus (which occupied the most forward part of the stage) was the most prominent feature in the earlier Greek plays. In modern buildings this form has, unhappily, gone out of fashion, except for scientific lecture theatres; but there is one fine example in the great Handel orchestra at the Crystal Palace, the appearance of which, when full, will convey some idea of what the auditorium of an ancient Greek or Roman theatre must have been when crowded with people.

Roman theatres differed from the Greek ones in the auditorium not exceeding a semicircle in extent, and in being constructed even down to a late period, and, when of large size, of wood, the resonance of which material was, Vitruvius tells us, relied upon to reinforce the sound; consequently the *echeia*, or brazen reinforcing jars introduced into Greek theatres, which were built of stone or marble, were not adopted in Rome. There has been much controversy about these *echeia*, and a very good condensed account of the facts known and opinions promulgated respecting them will be found in the "Dictionary of the Architectural Publication Society." It may be sufficient to observe that, though in all probability the resonance from them would not have flexibility enough to reinforce speaking, it would be admirably suited to strengthen the effect of slow-sustained declamation, especially if that declamation were of the character of musical recitative or chant; and if, as seems probable, the principal parts of a Greek drama partook of this character, we cannot doubt that the vases would be a real assistance.*

Among English lecture theatres that of the Royal Institution has always been deemed famous.

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* The following letter in the library of the Institute, though of an old date, is interesting as bearing upon the subject:—

"February 22, 1847.

"Dear Sir,—As in some degree connected with the subject of a paper on Acoustics now before the Institute, I have the pleasure of sending you a few lines to state that in the Church of St. Martin at Angèrs, in the walls and vaulting of its choir (which is said to have been built about the year 1020, and is of Romanesque architecture,) are inserted several small vases, which the architects and antiquaries of Angèrs suppose to have been there placed with a view of increasing the sonorous property of this choir, in a similar way as the 'echeia' described by Vitruvius are said to have done. These vases, as I was informed (for I had not an opportunity of examining any one), are of amphora-like shape, 12 inches deep, 10 inches wide in the centre, and from 1 to 3 or 4 inches wide at top and bottom. They are of gray baked earth, and inserted at right angles in the thickness of the walls and vaulting, their mouths being flush with the faces of the said walls and vaulting, so that when seen from below they appear to be nothing more than small holes for the admission of air between the extrados of the vaulting and the roof. The vaulting of this choir is of two bays, each quadripartitely groined, and the vases are disposed in each compartment by threes in a triangular form, at the distance of some feet from one another; but as to the distribution of the vases in the side walls I cannot positively speak,—the choir, when I inspected it, having been so full of fire-wood that I could only see one row of holes, about 4 or 5 feet apart. These vases are yet sound and sonorous, as I proved by getting up to some and inserting my walking-stick into them.—W. Bromet, M.D., F.S.A.

"J. J. Scoles, Esq., Hon. Sec. Royal Institute of British Architects, &c. &c. &c."

It resembles Roman theatres in being constructed of wood; its seats are arranged in a curve similar to the is-acoustic curve, and its dimensions are very nearly indeed in the relation to one another of 2, 3, and 4. Its outline presents a semicircle of 30 feet radius, with the ends prolonged 15 feet; and the ceiling is flat, the wall behind the speaker being flat also. One great advantage in this building is the comparatively small volume of air it contains: the favourable form and proportions help it; but it no doubt draws much of its excellence from the resonance of the wood employed in its construction.

Lachez in his pamphlet gives views of all the principal lecture theatres in Paris, and points out that most of them are defective through having too vast a space above and behind the speaker; and he shows that if we wish greatly to extend the space of such an auditory, the walls should radiate behind the speaker's head, and the ceiling should also be lower where he is than elsewhere.

All modern theatres for dramatic performances depend mainly, though not exclusively, upon direct radiation. In one of the most celebrated and most frequently quoted examples, however,—that at Parma,—the form was such as to favour conduction as well as radiation, while the resonance of the material, constructed as it was internally of nothing but boards, even to the ceiling, no doubt helped the sound very much. The Parma theatre is connected with the ducal palace, was built in 1618, and so far back as 1790 was in a state of decay. It must not be confounded with the modern Teatro Ducale at the same city. The dimensions of this building were considerable; its length from the front of the stage to the back of the gallery facing the stage is 130 feet, and the width 102 feet, the general form being an oblong rounded off opposite the stage, and the seats being ranged ampitheatrewise in steps. Notwithstanding the great size of this house, a low voice could be heard in every part, even if the speaker was as much as 10 feet back, making the distance from the speaker to the hearer 140 feet.

Of more modern theatres, not one perhaps, is so famous for acoustic effect as the Opera-house in the Haymarket, which was brought to its present form internally about 1790. Here again we have considerable dimensions, though not at all equal to those at Parma; but we have the entire interior constructed of wood, the ceiling of wood, and the stage brought so far forward that a singer may be almost in the middle of the auditory, and may be heard by all of them directly. The orchestra, of course, is even more among the auditors; the stage is extremely shallow behind the curtain; and the auditory is a little more than a semicircle prolonged by two almost straight sides, which approach each other as they reach the proscenium. The ceiling is an extremely flat curve over the pit, brought down above the stage to throw the voice forward, and there is a hollow unoccupied space above it. Altogether the form is undoubtedly favourable to sound in a high degree; the space above, behind, and at the sides of the singer is restricted as much as possible, and gradually swells out in the part where the sound is wanted to expand, while the divisions of the boxes, which do not radiate from the stage, would prevent any echo from the back wall, and break up any wave of conducted sound. More important, however, than the form, in all probability, is the use of resonant material and resonant cavities, and the entire absence of plastered surfaces.

There is one other group of public buildings which peculiarly require to be treated on the amphitheatrical plan, but which hitherto have always exhibited a sort of unsuccessful compromise in their arrangement. I allude to courts of justice. It is very desirable that the general public should hear well, and they have therefore usually been ranged on steeply-inclined benches; but this has ordinarily been done in a square and often a cubical room, so that all the disadvantages of the square corners and of undue height above the very persons to whom perfect hearing is essential are retained. In most old law courts various contrivances for contracting the space above the bench are visible; but it would be a much better construction if the court were from the commencement arranged so that there would be a fair prospect that those who *must* hear would hear *perfectly*, and that all others present would hear well.

The moderate size of our law courts points to the principle of direct radiation of sound as the one on which they must be constructed. The basilica, on the other hand, the form anciently employed for the same purpose, introduces us to the consideration of the second great division of buildings, namely, those where the transmission of sound is *assisted*, and whose peculiarity is that they are *oblong*. These divide themselves naturally into buildings with a nave and aisles, and simple large or small rooms. It will be, perhaps, desirable to consider first those buildings with nave and aisles of which the basilica may serve as a type, and afterwards to notice large rooms ceiled in one span, and small rooms. In the large cathedral churches of Mediæval times, where the object was not simply to build a church just as large as a single speaker might fill with his voice, but to raise a monumental pile for ceremonials, it was of no moment that the resonance of the air contained in the building should be great, so long as it did not destroy the effect of music; and these buildings afford accordingly a wonderful illustration of the sonority of a large body of air, but very few of them are easy to fill with a distinct spoken utterance. In Protestant churches of more moderate dimensions the main object undoubtedly is that read and spoken words, delivered from the reading-desk, the pulpit, or the altar, shall be perfectly audible to the congregation. How far does the ordinary arrangement of nave and aisles effect this? There is no question that the columns inseparable from such an arrangement interfere with direct sight, and partly with direct hearing; but I believe it will be generally admitted that the advantages attending upon their use more than counterbalance this disadvantage. I have stumbled upon a passage on this subject in Mr. Denison's lectures on church building, in which I think you will be able for once to concur with that gentleman. "It is at last discovered," says he, "that so far from the pillars and aisles and broken roofs of gothic churches, built after the fashion of the old ones, being worse for hearing in, they are generally better than the wide-spread buildings all under one span, like a railway station, which it was the fashion to erect in large towns a few years ago. This fact is noticed in two recent Reports of the Church-Building Society; and I had observed the same thing myself in several instances, even in small churches, though without knowing that it was general before I read it there. Certainly some of the worst places for hearing in that I know are buildings all under one roof, and of far less capacity than many churches, both old and new, of the nave and aisle construction, in which a large congregation can hear perfectly well; so that in this as in many other things, the old Gothic builders knew what they were about a great deal better than we do."

The system of open roofs, of a high pitch, so as to accord somewhat with Gothic character, and carried from wall to wall of a wide building in a single span, was some years ago employed a good deal for Dissenting chapels; and many instances have occurred where these places are bad for hearing, in some instances to a serious extent. The English Chapel Building Society is now employing its efforts to promote the erection of buildings divided into a nave and aisles, even where the size of the place of worship is but small.

The position of the pulpit in churches and chapels with nave and aisles is a point of considerable importance. In chapels for Dissenters it is usually placed in the centre of the end of the building, with the communion-table in front of it. In churches it is almost necessarily placed at the side, principally that it may not intercept sight of the chancel and hearing of the Communion service. There is, however, another quite as good reason for this position, which is, that a centre aisle is almost essential to the decent arrangement of a church; and it is in the highest degree unpleasant to a speaker to have the empty bareness of the aisle in front of him whenever he lifts his eyes, while it is equally unsatisfactory to the congregation to see their minister as nothing better than a dusky shadow, projected on the light of the east window, before which he necessarily is fixed, if his pulpit be central. Is this position acoustically bad for the pulpit? and (whether at the centre or the sides) should the pulpit be

far forward or not? In answer to these inquiries it seems clear that if the building be thoroughly good to speak in, it will not be so very material where the pulpit stands; but I have no doubt that in doubtful or bad cases, especially where there is echo, the side position of the pulpit is much more likely to prove advantageous than the central one, and on that ground is to be recommended, even for Dissenting places of worship; for the voice being naturally directed towards the main mass of the congregation, will be sent, not straight against the end wall, but obliquely against a side wall. It is, I believe, always bad to place a pulpit directly against a wall. The practice of Sir Christopher Wren, followed by many good architects, is to put it forward some distance into the nave. Others withdraw it into the chancel, or under the chancel arch. The choice between these two positions must depend rather upon the shape of the church—if it be nearly square, so that the hearers can be grouped round the preacher on the direct radiation principle, I would put the pulpit forwards among them, and place it against a column, as is done in the great Continental churches. If the church be long, and the hearers must be reached rather on the speaking-trumpet or conduction principle, the pulpit will probably answer best drawn back under the chancel arch. If there are transepts, and a difficulty is found in making people in the nave hear (and this often happens with transepts) it will be quite worth while to try drawing the pulpit a little back into the chancel—for it generally happens in these cases that the communion service, read from the altar, is better heard down the nave than either the prayers or the sermon, owing to the direction the parallel walls of the chancel impress on the sound.

Wren's churches, it seems to me, may be studied as models of arrangement for church-building in large towns; the more so, because, while classic in style they follow the forms of Gothic churches in plan and section. It is remarkable that, notwithstanding his unrivalled constructive skill, which gave him every inducement to erect a wide roof, he has not, so far as I know, left a single church without columns in the interior, except only the very smallest. In almost all cases he has placed the pulpit some way down the nave, and in all the proportions of the cross section, while they avoid the vice of being cramped, present a certain general impression of lowness when seen on a drawing. It seems agreed that, except in excess, the timber trusses of open timber roofs are advantageous on account of breaking up echoing surfaces; but I fancy that, so far as it goes, the sharp angle which the two sides of such a roof make at the ridge forms a noisy sort of trench, and that a better effect is obtained where a wooden ceiling is thrown across at the level of the collar or higher. This will partly depend on the proportion of the church. Galleries are, if properly inclined, not themselves bad places to hear in; but the spaces under them are bad, unless the galleries are shallow. This especially applies to side-galleries; an end gallery may safely be deeper. Such a gallery sometimes helps to prevent an echo, or the introduction of one will often check an existing echo.

On church building, finally, we have among old authorities, not only the practice of Sir Christopher Wren, but his recorded opinions, embodied in a letter, from which, had time permitted, I would have made an extract. The document in question is to be found in the "Parentalia," and expresses Wren's conviction that 2,000 was about the extreme numbers that could be accommodated in one church, which he prescribes ought not to exceed 90 feet long by 60 broad. He observes further:—"A moderate voice may be heard 50 feet distant before the preacher, 30 feet on each side, and 20 feet behind; and not this unless the pronunciation be distinct and equal." And from this starting point he seems to have regulated his practice.

As to modern practice, the members of this Institute ought to be able to furnish full information on church building, considering the great activity that has lately prevailed in that branch of practice.*

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* The following extract from a letter from S. S. Teulon, Fellow, furnishes some useful hints:—"My theory on the

The last topic on which I have to trouble you relates to buildings without any columns internally—in fact, large rooms. The most difficult subjects for the architect to treat would seem to be rectangular rooms—perhaps those of moderate size being worse to encounter than larger or smaller ones. Among these I would include great and small halls, lecture-rooms, and concert-rooms, and also the majority of Dissenting chapels, together with such churches as are not built with a nave and aisles. A rectangular room of considerable size is the commonest form for apartments destined for great assemblies, and is so simple, and has become so natural, that it will probably never cease to be usual for northern nations; and yet it lies open to nearly all the obstacles which we have described as besetting buildings of one or another class. Its flat floor renders it liable to the obstruction of the direct lines of hearing; its straight ends almost preclude any arrangement of auditors on a semicircular or segmental curve; its flat sides and square angles are very apt to reverberate; its flat ends, coupled with its considerable dimensions, expose it to echo; the mass of air in its height and at the back wall tends to swallow the speaker's voice; and even its very dimensions allow space for the voice to decay, while it is very possible that its windows or its skylights may afford opportunities for sound to be generated of a disturbing character. I am not prepared to bring forward a single instance that unites all these disadvantages, though Exeter Hall, before the alterations, might have been adduced as exhibiting a good many of them. I am, however, better pleased to invite your attention to one or two cases were these obstacles have been all successfully surmounted, and from the consideration of these we shall be able to form some tolerably definite ideas of what a great hall ought be. We will first consider the case of the Free Trade Hall,

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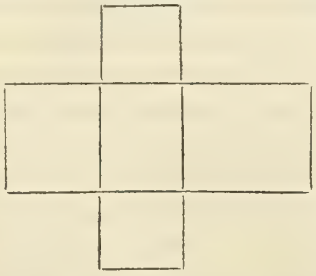
subject is a very simple one, and was derived from this circumstance. Some years ago Lord Calthorpe sent me to survey a church in Suffolk, with a view to additions. The church (a Norman one) consisted of a chancel, tower, and nave, in one continuous line, thus—the usual Norman plan :

I found upon examining the church that there had once been a transept on the south side, and so I considered the reproduction of this a natural addition, but being insufficient for the required purpose, I proposed also another on the north side, making it a perfect cross. 'Well,' said the Clergyman, 'I like the plan very much, but what we shall do about acoustics if it is carried out I don't know, for *no one can hear my voice* (which, by-the-bye, was a very powerful one) in the church now.' My own expectation was that the addition would be a cure. It so came to pass to the surprise of himself and others, that at the reopening of the church a very moderate voice was distinctly heard throughout. How was it? The pulpit, it is true, was placed in the area of the tower, with the belfry floor as a sounding-board, but this had always been the case, therefore, I came to the conclusion, that besides the fact of the undulations of sound being allowed to flow on by the addition of the transepts (instead of being cônfused, as it were, and, so to speak, made to clash by the long narrow nave, tower, and chancel), the speaker's voice impinged upon two equi or nearly equi-distant points, viz., on the south wall of the transept, and the west wall of the nave, and so united or concentrated the sound within the area of the church.



Be this view of it a correct one or not, I have, in consequence, ever since endeavoured so to place the pulpit in a church that the preacher's voice might reach two extremities equi, or nearly equi-distant, from his position, and I believe I may say I have not known this to fail. I believe the *position* of the speaker has more to do with acoustic success than we are inclined to think, nevertheless there are evidently some forms of plan impracticable in this respect, as was the case with the church to which I have referred before the additions were made.—Your's very faithfully, S. S. Teulon."

Manchester, the work of Mr. Walters, who has most obligingly furnished full information respecting it. The requirements here, as in most great rooms, embraced fitness for both musical entertainments and public speaking, with accommodation for a very large audience, and good architectural effect. All this has been successfully accomplished. The dimensions of this hall are very considerable; they are, as measured from the contract plans:—The internal height, 52 feet; width, 78 feet; length, 135 feet; thus bearing very nearly the simple arithmetical relations to one another of 2, 3, and 5. The plan is a parallelogram, with a semicircular sweep at the end opposite the orchestra. The orchestra is partly in a recess with a roof curved upwards, but advances into the body of the hall. The side walls are low, the ceiling coming down on to them with a cove of unusual height. The side walls are plain below the gallery, the upper part of them being broken only by engaged pilasters, so that what reflecting power they exercise will be favourable; but at the remote end, where conduction along the walls would commence, and at the semicircular end, the surface is broken up so as to dissipate or destroy the conducted wave of sound. Columns here take the place of pilasters. Deep, open recesses, used as private boxes, are formed, and balconies are thrown out on corbels; while the gallery, which at the sides is shallow becomes here deeper, so as more effectually to check the sound that might reach the back wall, and be echoed. The doors of entrance are here, too, covered with cloth; and lastly, the front of the gallery itself has a section of compound curvature, so that it cannot echo. These precautions, coupled with the curved end of the room, are successful, and there is no echo. When full this hall is very successful, either for music or for speaking; but when empty the resonance on it amounts to reverberation. The good result here, it will be remarked, is mainly due to form and proportions; resonant material is not present in an extraordinary quantity, for the walls are plastered, and so is the ceiling; the floor, however, has a space underneath it, and there is a large space above the ceiling. I believe there is a good deal of woodwork about the orchestra—the most important part—and there is a large organ there, the presence of which in an orchestra, I cannot help believing, is always likely, even when not played upon, to be a slight auxiliary to sound. Another example of great fame in the north of England is the Philharmonic Hall, in Liverpool. I have hastily visited it, but am not in a position to speak of its good qualities from personal experience, or to lay before you any authorised information, except what appeared in the "Builder" at the time the hall was erected. The architect is Mr. Cunningham; and the dimensions given in the "Builder" are, extreme length, 135 feet; extreme width, 102 feet; extreme height, 68 feet; open part of hall, clear of boxes, is 106 feet by 68 feet. Calculated accommodation, 2,300 persons. The appearance of the hall on entering is most peculiar: two elliptic arches of vast span extend along the two sides, while smaller ones cross the end; and by these the very considerable dimensions of the hall between the walls are masked, and it is brought to appear a moderate-sized apartment with a domed ceiling, and having four recesses opening out of it. These recesses are occupied, one of them by the orchestra, and the other three by two galleries, one above the other, and receding back. The orchestra is the only place where resonant material appears to have been employed. It is built of wood, and contains hollow cavities of considerable size. In all other parts the architect seems to have dreaded resonance as much as echo. The surfaces likely to echo are curtained over and divided with great care; the boxes into which the galleries are divided are hung with draperies, and on nights of concerts the floor is covered with a carpet, and all the seats are cushioned. I have been given to understand that the effect upon music is, that it is heard most distinctly, and quite free from reverberation or echo, but that the room affords no support or assistance to the voice or instruments. It is, perhaps, not right to conclude a reference to this building without observing that, in arrangements for ingress and egress for the comfort of its occupants, and so far as one could judge, for ventilation, it is one of the best and most liberally planned structures we have.

Coming nearer home, we may refer to the very large and very successful music hall in the Surrey Gardens, for authentic information respecting which I am indebted to the architect, Mr. Horace Jones. In this large building upwards of 8,000 persons have been assembled to hear music and to hear preaching, and in either case have they done so without difficulty. The general form of this building is well known. It is an elongated octagon, or a parallelogram, with octagonal ends, and into which the walls of four octagonal staircases project. At the end opposite the orchestra, and up the two long sides, are built three tiers of galleries, with fronts of curved section, and supported on iron columns. The roof over two of these galleries is horizontal; that over the third one inclined; and that over the central space is very similar to the one at Liverpool, both being domed rather like the bottom of a ship. The dimensions of this hall are very considerable. The extreme height and extreme width are within a foot the same; the width is 68 feet 6 inches; the height 69 feet 6 inches; the length 153 feet 6 inches, or two and a quarter times the width—another instance of simple proportions. The form is well chosen, and the galleries act extremely well to prevent echo and reverberation, while yet they are not so near together but that they can be well reached in every part by the voice. The principal reliance of the architect for musical beauty of tone was, however, placed upon the use of resonant materials. The walls are lined with matched-boarding on battens, and it was at one time intended to form the ceiling also of wood. The orchestra is constructed of thin, well-seasoned planks, and there is a sounding-board over it in a slightly inclined position, the action of which is believed to be very beneficial. This is not only of wood, but it was specially required to be of *old* materials. That these various precautions have been successful is a matter of notoriety; and, in fact, they have answered so well that this hall has been pointed out to me by a professional musician as one of the best music rooms in London, not only relatively to its vast size, but absolutely.

Very many other rooms might be brought forward and analyzed, even of those in London alone. To refer to only two others, we will take the ball-room at Buckingham Palace and St. Martin's Hall. The ball-room was built by Mr. Pennethorne. The dimensions are 110 feet by 60 feet, by 45 feet, bearing to one another very nearly the relations of 3, 4, and 8. The angles of the room are rounded, the ceiling slightly roughened with ornament, and brought on to the walls by a cove. The cornice has very little projection, and the lower part of the building is lined with boarding, covered with silk. There is a recess at the end opposite the place for the music, broken up with pilasters, &c., so as to dissipate echo. This room is admirable for music. St. Martin's Hall was mainly designed, so far as its adaptation for acoustic purpose goes, by Mr. Hullah himself. It measured, according to the account published at the time it was opened, 121 feet 6 inches long, by 55 feet 5 inches wide, and was 40 feet high. The dimensions cannot be exactly reduced to any very simple relation, though they are not very far from 2, 3, and 6. The nearest to them are 5, 7, and 15. The height and length, however, are very exactly proportionate, the height being one-third the length. This room had no recess for orchestra or organ, but the orchestra, probably the most perfect one in London, was built up of wood against one wall. There was a gallery rather deep across the end, and shallow at the sides, with the front carefully reduced to the minimum of surface. Facing the orchestra was a recess, partly breaking up the end wall. The windows were all high up and were slightly recessed. The distinguishing feature of this room was its great wooden ceiling, flat in the centre (which occupied about half the entire width), and sloped down at the two sides to meet the walls. This was panelled, and there were hollow spaces over it, and under the floor. The room, when full, answered to perfection for music, but it was, when partly filled subject to reverberation, owing, no doubt, to its extreme resonance.

Among the smaller public rooms there are a great number of examples of a class for the acoustic construction of which I would earnestly bespeak more care than has ordinarily been bestowed upon

them. I refer to the small public rooms in suburban villages or country towns, the failure of which is as great a calamity for the community to which they belong as the non-success of the most important structures would be in great cities. These rooms are, perhaps, more frequently than not imperfect, and consequently fail of their end, which is to afford the inhabitants of the place where they are built a good meeting-place on public occasions. Ordinarily the small means disposable leads to the walls being built bare and unbroken, but plastered. The ceiling is often too high for the other dimensions of the room, and if there is any semblance of an open roof, it is so thin and slight as to offer little or no obstacle to reverberation. Very frequently too, circumstances render it advantageous to light these places from the roof, and skylights that act as sound traps are formed, or if not, at least the walls are left quite devoid of any breaks. It would be desirable in building such a room to pay regard to good proportion, and where practicable to light from side windows. If this is not admissible, probably it will be advisable to break the line of the walls by piers and arches of moderate projection; and above all, to form some description of break or recess, or cant or curve, in one or both of the end walls, and to make the ceiling drop down at the ends. It would be wise partially to line the walls with wood, or form a wooden ceiling, and if it is necessary to keep the surfaces plain, not to plaster them internally. In existing rooms that are bad the best remedy must be usually left to the judgment of the architect, as the circumstances of the case will vary; but the most generally useful and the most inexpensive palliative for reverberation—the usual vice of these small halls—is to hang up curtains in various parts. Matting or carpet on the floor might often be of use, and a sounding-board, or even a sheet of canvas, so stretched as to cut off part of the air above and behind the speaker, might often be advantageous.

The subject has now been pursued to the extent permitted by the limits of a single paper, and I propose to conclude by recapitulating the principal steps by which our investigation of it has advanced. We have then considered the general laws of sound, and the modes of assisting sound in a building, namely, reflection, as from a sounding-board, referring especially to the parabolic sounding-board; conduction, as in the speaking-trumpet; and reinforcement by resonance as in the violin. The subject of impediments next required attention, and we have considered echo, reverberation, obstacles, with the is-acoustic curve as a means of escaping them, and bad proportion. Lastly, we have referred to the application of these general principles to particular cases, dividing them, according to size and shape, into buildings for direct radiation of sound, or square and round buildings, and buildings for conduction of sound, or oblong buildings. Among the former we have noticed theatres, ancient and modern, lecture theatres, and courts of justice; among the latter, basilicas and other buildings with nave and aisles, concluding with rectangular rooms both of large size and of moderate dimensions.

Mr. Scott Russell, Visitor, in responding to an invitation, said he would be chargeable with ingratitude if he did not express his thanks to Mr. Roger Smith for the information contained in his essay. Although he could add nothing new to what Mr. Smith had said, he would venture to refer to a few instances which had come under his own observation, in illustration of the practical hints which he had thrown out. Certainly a great difficulty was to convert an ordinary room into a good sounding room. There was a radical difference between the necessities of a big room and those of a little one. A little room was infested with inconveniences which arose out of its very littleness, and no doctor or quack could get rid of them. The public generally insisted upon the form of a parallelogram, large flat surfaces and a flat ceiling, and there was really no cure for such a building. Under these circumstances all that could be done was to choose a tolerably good proportion, and make the room conform exactly to it. He differed from Mr. Smith in thinking that he had not yet got the exact proportions for acoustic purposes, for he thought that if they took the ordinary harmonic

numbers—2, 3, 4, and 5 (all of which were good acoustic numbers)—and took them in length, breadth, and height, they would procure a room which would speak easily, and resound to the human voice. If, on the other hand, they were only to come near to these numbers, the result would be a room which would neither speak nor sound. He believed that when they had the choice, if they kept the roof high, they would endeavour simply to avoid echo; but that if they wanted an audience to hear the speaker or singer they must keep the ceiling low. If the room were low, and the speaker placed himself high his voice would soon cease to strike the room at a reflecting angle or would spread equally. He had first noticed this in rather a remarkable manner. In Scotland, as they all know, half the church went out from the other half, and had no place to go to. The general assembly had met in a high narrow building in which no one could hear what anybody else said. The new body went to a low building where the ceiling was 15 feet high, and the floor about an area of an acre, where the audience (consisting of half the ministers in Scotland and their congregations) heard each other very distinctly, because the sound sensibly travelled along the low roof. The difficulties of echo would beset all large parallelograms. In theatres an attempt was made to get rid of them by breaking up the space with boxes and partitions; but he believed that the best form of building for 1,500 or 2,000 persons would be one pretty nearly a circular or an octagon, or a quadrant. One of the best churches for hearing which he knew of in this style was that of St. Stephen, at Edinburgh, which was an enormous octagon, and in which from 2,000 to 3,000 persons could hear very distinctly a clergyman who had not a loud voice. In this church there were no echoes. The best form that he knew of for hearing and seeing was a circle, with the seats rising one above another, and covering as much of the bare wall as possible. The worst form was that nearest it, namely, a semicircle, with a great flat wall to echo the voice The courts of justice, for instance, were built in this manner; and he could point to at least half a dozen of them in which nobody could see or hear anybody he wanted to see or hear. There was another point to which he would refer in reference to this subject. It should be borne in mind that there was one set of noises which it was desirable to hear, and another which it was undesirable to hear; and the great desideratum was to make a building in which what it was desirable to hear would be audible, and that which it was undesirable to hear would be inaudible. No one, for instance, wanted to hear, either in a church, a concert-room, or a theatre, fidgetting, rubbing of feet, or chattering. These were noises which no one particularly wished to hear, and theatres were generally so well constructed for hearing what passed on the stage alone that the audience were very seldom disturbed by the not unfrequent loud conversation of persons in the boxes. Her Majesty's theatre was the most wonderful building for hearing and seeing in, and he did not think he could suggest anything better, although it had small faults which might be corrected very easily. He did not think the difficulties to be overcome were so great with a large as a small building; for, where the building was very large, there was no bother on the score of resonance; and if the seats were raised behind, and the wall covered with heads to swallow the sound, the probability was that it would answer very well. The great secret of success in making a large building hear was to cover it with heads, for in a large building the voice required to be assisted. In a small building, on the contrary, the difficulty was to suppress the echo of superfluous sound. He could personally speak to the accuracy of Mr. Smith's statements with regard to the parabolic reflector, for he had tried it when he was a guest at the house of Mr. Blackburn. It was indeed, as represented by Mr. Smith, "villainously ugly;" and, moreover, prevented the congregation at either side of the preacher from hearing him. He therefore hoped that it would never be generally adopted in our churches. He also agreed with Mr. Smith in thinking that resonant roofs were great aids to hearing; that the roofs of churches should be of wood; that the top of the pulpit should be of the same material, and as large as possible; as, if this precaution were not

taken, it would be impossible to prevent the speaker's voice from being lost. He did not believe in the parabolic form, but he believed that if the end of a building were narrowed near the speaker, the roof inclined, and the walls covered as evenly as possible by the audience, every auditor would get his share of the sound: and that, by attending to these principles of construction, all would be done that human skill could do to assist the voice. He begged to propose a vote of thanks to Mr. Smith for his excellent and instructive paper.

Mr. WHITE, Fellow, seconded the vote of thanks. It occurred to him that the proportioning of rooms to given ratios approved itself to their notions of what they might naturally expect to be good for sound. He thought that these ratios should be such as to allow of the successive reverberations being repeated at angles of accidence and incidence, which should upon their recurrence coincide with each other. He thought with regard to the old churches there was in this respect more than many persons seemed to admit of a careful conventional treatment as to such proportions, as well as their general forms, at any rate in the original design of each, although it was not in all cases carried out with equal accuracy. And in reference to this subject he wished to correct a false impression conveyed to the Institute in a lecture on symbolism some time ago by Dr. Barlow, who had quite inadvertently misapplied some remarks bearing directly upon this very subject in a paper by him (Mr. White) on Modern Design, as belonging entirely to an extraneous matter treated of in another paper; the former of which papers in reality referred to the analysis of the geometrical proportions of mediæval buildings from the 11th to the 15th centuries, and had nothing whatever to do with symbolism, excepting, perhaps, in an incidental way. In that analysis he (Mr. White) observed that those buildings which were most beautiful in general form, and in proportion especially, were also the best for sound. Moreover, as regarded general form in such buildings a low aisle with a lofty nave was the best for sound. Then again the pitch of the aisle roof ought to be very low, say from 10 degrees to 12 degrees, and not as was so commonly the case about 45 degrees. But he thought that the extreme wall or boundary in front of the speaker was of greater consequence (towards the proper retention of sound) than any sound-board or reflector behind him; for in open air it was found to be better for the speaker to have his hearers between him and an opposite wall, than to speak towards the open space with a wall behind him as a reflector, as he had witnessed in the case of the Bishop of Lincoln addressing without difficulty a large assembly in a small country churchyard. At the same time the reflecting wall was of considerable importance, as was evidenced in the large and lofty church of Dorchester, Oxon, where the clergyman was heard distinctly from the extreme east end over the whole of the portion occupied for service, better, in fact than from the pulpit. This church was a good instance of the fitnesss of a carefully designed and medieval building for sound.

Mr. J. W. FRASER, Visitor, referred to an enormous sounding-board in a church at Amsterdam; it was from four to six times the size of the pulpit. He thought Mr. Smith had given a great deal of interesting theory, but not much of positive deduction or figures. He (Mr. Fraser) had seen Professor Donaldson of Edinburgh illustrate the effect of sound by the vibration of a flat surface over which sand had been distributed, the sand assuming certain geometrical forms according to the vibrations. Professor Donaldson was building a large hall for music and lectures in connection with the University of Edinburgh. This would probably be finished next year, the proportions adopted being, he believed, 30 feet wide, 45 feet high, and 90 feet long. This proportion he had adopted after much consideration and calculation, without being under any control or restrained for want of funds.

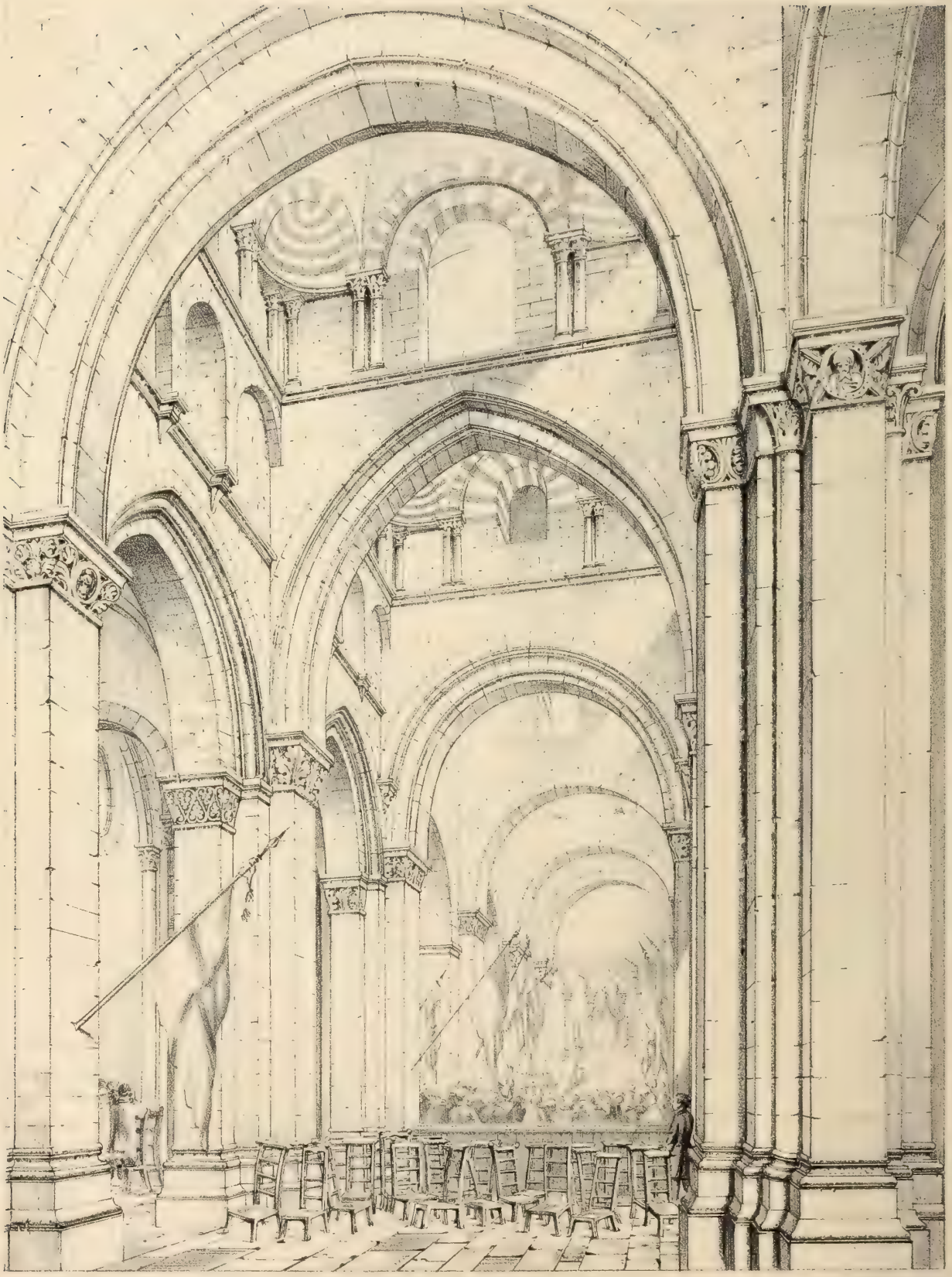
Mr. SCOTT RUSSELL said he knew the room referred to, the exact dimensions of which would be 96 feet long, 48 feet wide, and 32 feet high, being just the three proportionate numbers of musical harmony.

Mr. C. H. Smith, Visitor, observed that sound depended very much upon the density of the atmosphere, for supposing all the conditions in a room to be equal the same sound would be heard more distinctly in the denser atmosphere of winter than in summer. Then again some substances repelled whilst others absorbed sound. In a linen draper's shop or a carpet warehouse it was difficult to make the voice heard from one end to the other; and sound was much more distinct in an empty theatre than in one filled with spectators, with woollen clothes, hair, &c. The rooms of the Royal Society (now occupied by the Geological Society) were so sonorous that it had been necessary to hang up woollen curtains to absorb the sound and to prevent echo. The effect of temperature was shown by the fact that if in a large orchestra, where the instruments were all in perfect tune, a current of cold air was let in by the opening of a door, the instruments were all immediately put out of order. Experiments on sound should be tried with a room full of persons or nearly so.

Mr. Morris, Associate, said that one of the most important questions for an architect was the position of a pulpit in a church, and it appeared to him that the pulpit should be as near the wall as possible. Generally the communion service was better heard than any other part of the service, the communion wall producing in fact that kind of abatement of the ceiling and narrowing of the walls which Mr. Scott Russell recommended. He was yesterday in a church where the reading desk and pulpit rose one above the other in the middle of the church. The reader was heard with great distinctness, because the pulpit was behind him, but when the minister preached in the pulpit without any reflector or sounding board the voice was altogether lost.

Mr. Penrose, H.S.F.C., paid a warm tribute to the learning and scientific knowledge displayed by Mr. Roger Smith in his paper. When the late Justice Maule was told by a friend that he was anxious to build a room well adapted for sound, he replied, "Then be sure you don't tell your architect so;" but the reproach that acoustics was a science not understood by the profession would soon be done away with if such papers as the present were more frequently produced and more carefully studied. In a room especially intended for music of even so inconsiderable a length as 30 feet he had found great advantage from the use of a wooden ceiling. For the evening services at St. Paul's Cathedral it had been found necessary to place something over the head of the preacher to prevent the sound ascending and consequently returning as an echo from the dome. He accordingly put up a sounding board of peculiar form, the effective part being an inverted curved surface, the reverse of the parabolic sounding board, of which mention had been made. It answered the required purpose and had the additional effect to some extent of propelling the sound which would otherwise have been lost in every direction. He found he could now hear less distinctly in the gallery than on the ground below; excepting for the effect of the sounding board the position in the gallery, owing to the uninterrupted space traversed, should be the most favourable, but the addition of the reflected to the direct sound, of which the lower position had the advantage, was the cause of the above-mentioned result. A preacher speaking distinctly and slowly would be heard at 120 feet distance. The arrangement of nave and aisles might probably be more favourable to sound than the parallelogram, though St. Pancras church was a successful example of the latter form. Semicircular roofs were bad for sound, unless there was a great height, as at St. Paul's, up to the springing of the arch. In a low building the ventilation would be apt to be imperfect, and the quality of the air was a considerable point in the transmission of sound. This was evidenced by the distinctness with which the voice was heard in the open air, where the atmosphere was not at all vitiated. In the present stage of the subject he thought the admirable statements of the principles of acoustics put forward by Mr. Smith were even more valuable than abstract numbers.

The vote of thanks was carried unanimously, and the meeting adjourned.



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INTERIOR OF CATHEDRAL OF NOTRE DAME LE PUY.

ON THE CHURCHES OF LE PUY EN VELAY, IN AUVERGNE.

By George Edmund Street, Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, January 7, 1861.

In the course of last autumn, after having spent three weeks in climbing Swiss mountains, I was able to devote a few days, on my way home, to a district which, as far as I had been able to gather from books, appeared to contain a mine of interest for the architect, not less than for the geologist, and the lover of natural scenery.

From Lyons I went by Monistrol to Le Puy, which was the grand object of my tour; and from thence into Auvergne, and by Brioude, Issoire, Clermont Ferrand, and Nevers, to Bourges and Paris. I was so much struck by what I saw that, though I am well aware that my visit was too hurried to be at all exhaustive, I think I cannot do better than give you the results of my journey, in the trust that what was full of interest, novelty, and instruction for myself, may be of some use also to others who have not yet been able to make this journey for themselves. The complete-Gothic architecture of Vélay and Auvergne is not, it is true, to be compared to the best work in the North of France; I am not, however, going to tell you about it, but about an earlier style, which, as I hope to show, has special value as illustrating, among other things, the way in which French Gothic was developed from Romanesque and Byzantine buildings; and our attention will, therefore, be almost entirely devoted to buildings which are either Romanesque or Romo-Byzantine in their character, or in the period of transition from those styles to first-Pointed. The complete-Gothic buildings are comparatively few, and have no special value; and I shall, probably, not have time to-night to refer to them even in the most cursory manner.

The most convenient course will, probably, be to describe shortly some of the principal features of these buildings, and then, if I have succeeded in giving you an accurate impression of their character, it will be the more easy to enter on some of the very interesting questions which they appear to suggest, and on which I specially desire not to dogmatise; because I trust there are those among you who will be able to throw much light on any questions which may be suggested, and, if necessary, to correct the conclusions to which I may have come too hastily, or from insufficient knowledge of discussions which have already taken place.

I will begin with Le Puy. On the wall you will find some photographs which will show you how eminently picturesque is the site of this ancient capital of Vélay. The city is crowded up the side of a volcanic rock, one end of which is crowned by the picturesque mass of its Eastern-looking cathedral. It consists of a network of narrow streets not passable by carriages, and reminds one forcibly of some such city as Genoa. Above the rock on which the cathedral is perched rises another, called the Corneille, on which are some old fortifications, and which has just been crowned by a monstrous image of the Blessed Virgin, made of the metal of guns taken at Sebastopol, and to whose charge I may fairly lay much of the imperfection of my account of the buildings beneath her feet: for I had the ill-luck to arrive at Le Puy only three days before the inauguration of this statue, and I found the whole city so entirely occupied with preparations for the fête, that it was with the greatest difficulty that I examined the cathedral at all, and into some portions of it I was quite unable to penetrate; whilst the only condition on which I could obtain rooms at an inn was

that I should not stop for more than two days, and should make room for some Bishop, Prince, or Cardinal (of whom there were a legion on the road), before the great fête day. I had to work very hard, therefore, to do as much as I did, and I make no doubt that a more leisurely and uninterrupted examination would have enabled me to discover and do much more. Separated from the great volcanic rock I have already mentioned by one or two furlongs only, is the smaller, but even more striking rock, called the Aiguille de St. Michael, and crowned with a little chapel dedicated to that Archangel. It rises, in the most abrupt and precipitous manner, to a height of about 265 feet. The distant background includes a series of truncated conical hills, evidently ancient volcanoes, and from almost every point of view a landscape of the most picturesque and extensive description is seen. Nor have I often enjoyed a more charming ride than that which, for the last twenty miles into Le Puy on the road from St. Etienne, made me generally acquainted with the remarkable physical formation of this mountain district, and was in all ways most beautiful, just when, some twelve or fifteen miles before I reached the city, I first saw the "angelic" church, as it is styled, standing up boldly on its rock, the centre of an almost matchless landscape.

The story of its claim to this style of "angelic" is this:—Bishop Evodius, at the end of the sixth century, on being made first Bishop of Le Puy, wished to construct a church. The Virgin, who had before shown to St. George the place where she wished one to be built, appeared to a sick woman on the Mount surrounded by a crowd of angels, and desired her to tell Evodius to proceed at once with his work. After much prayer he went to Rome, and the Pope sent back with him an architect and senator named Scutarius, under whose auspices the church was soon built, and whose tombstone is still to be seen near the transept door. Evodius and Scutarius then started for Rome again, but on the way met two old men, who gave them two boxes of relics, and desired them to return to Le Puy, saying that as soon as they arrived with the relics before the church the doors would open, the bells would ring of themselves, the whole interior would be bright with torches and candles, and they should hear divine melodies, and smell the sweet perfume of the heavenly oil which had served for the consecration of the church by the angels. Everything happened just as had been foretold, and Evodius felt it unnecessary again to consecrate his church, which from that time to the present day had been called the "angelic" church. No doubt you all know how curious a parallel to this legend the history of our own abbey of St. Peter at Westminster affords.* But, in searching for information about the churches of Auvergne, I came upon a continuation of the Le Puy legend, to which the Westminster story affords no such parallel. This second legend tells how, when the

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* I give an extract from "La Estoire de Seint Edward le Rei." M.S. Bibl., Publ. Cambridge. Ee. iii. 59.—

"Seint Pere, du ceil claver,
"Va sa iglise dedier,
"Des angeles mut grant partie
"Li funt servise e grant aie.
"Li angele chantent au servise,
"La nuit quant dedient l'iglise:
"Tant ja du ciel luur
"Ke vis est au peschur,
"Ke li solailz e la lune
"Lur clarté tute i preste e dune."

This is the rubric descriptive of the illustration, whilst in the poem itself is the following passage:—

"E cist si tost cum arive
"Entrez est en sun muster;
"Li airs devint lusanz e clers,
"N'out en muster tenegre ne umbre:
"Atant des angres grant numbre,
"Ki s'en venent a sun servise
"A dedier cele iglise
"Tant ja partut odur,
"Ke vis est a cel pescur
"Ke li solailz la lune
"Sa clarté tute preste u dune
"Angles pu cel avaler
"Regarde e puis remunter;
"Teu joie a, ke li est vis
"Ke raviz est en Parais,
"Pur l'avisiun k'apert."

"seraphic basilica" of Le Puy had been thus dedicated, St. Anne descended from heaven to visit the palace of her daughter. Not content with this human work, she seized the hammer of the master mason, and, taking wing, descended on the summit of a hill, and, turning towards Auvergne, which to her mind offered no church worthy of the Queen of Heaven, she threw the hammer, saying as she threw it "On the place where the hammer falls a church shall rise." The hammer fell on the right bank of the Allier, and immediately there rose from the soil like a flower the church of Les Chases, which was dedicated forthwith to St. Mary.* The moral of the legend seems to be—1st, that architects are not always wanted, and 2nd, that, as it is certain Les Chases was not a Gothic church, it may be argued by any one hard up for an argument against Gothic that St. Anne and the angels evidently had no sympathy with the style.

Let us now leave legends, and direct our attention to the ground plan of the cathedral. Its architects have contrived to cover in an ingenious manner the whole of the summit of the rock on which it stands. It consists of a nave with aisles, transepts, a choir, and choir-aisles, and a steeple at the east end of the north choir-aisle. To the south of the cathedral is the modern Bishop's palace, whilst to the north are the cloisters, two grand halls, some ruins, and to the north-east a chapel dedicated to St. John, and other buildings. There are entrances in the east walls of each of the transepts, but these were rather intended, I suppose, for the exit than for the entrance of the people, and the mode in which they were admitted forms one of the most striking features of the whole scheme. I said that the church was built on a rock, and its western face, forming one of the principal streets of the city, is so steep as to consist alternately of steps and inclines, until at a short distance in advance of the west front, when it is changed to an almost interminable flight of steps. The grand west entrance is an open porch, like an enormous crypt, beneath the three western bays of the nave and its aisles, whose walls and piers it reproduces in its plan. The steps† formerly rose in a straight line, until they came up in the very centre of the church, in the fifth bay of the nave, and in front of the rood-loft, and of the miracle-working image of the Blessed Virgin, which, brought from the East and given to the church by St. Louis, was, until its destruction in A.D. 1789, the greatest attraction for pilgrims in France.‡ This singular entrance, and the mode of exit by the eastern doors of the transepts, gave rise to an old saying that "In Notre Dame de Puy one entered by the navel and went out by the ears." Unfortunately, however, the central entrance has been diverted, and after ascending 102 steps, and arriving at the Golden Gate, as it was called, the passage branches right and left—to the left ascending into the cloister, and to the right winding round the south side of the church, until the 135th step lands the weary pilgrim in the south aisle, near the transept.§ This, then, is the general scheme of this most singular church. Let me now go on to describe it in detail, beginning with the oldest portion. This comprises the choir, the transepts, and "crossing," and the two easternmost bays of the nave. The choir is completely modernized, and I am unable to say whether any portion of the internal arrangement is old. It presents the peculiarity of a square exterior and a circular interior. This is a not uncommon arrangement in the earliest Italian examples of the apse, and is seen at St. Mark's,

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* L'Auvergne au Moyen Age, by M. Dominique Branche. Clermont, 1842.

† The steps are arranged in successive groups of eleven steps, with platforms between them.

‡ As evidence of the popularity of Notre Dame du Puy this may suffice.—In Amiens Cathedral, until A.D. 1820, there existed a series of pictures given by the "Confrérie of Notre Dame du Puy." A similar confrérie existed at Limoges.

§ The passage to the right is evidently modern, that to the left looks as though it were ancient, but a protest against the removal of some ancient work, in the course of constructing it, which I have found in the Bulletin Monumentale, seems to show that it is not so.

Venice, and elsewhere. The arches opening into the choir-aisles are old, and I believe that we may venture to say that the original plan must have been very nearly the same as that of the church of St. Martin d'Ainay, at Lyons, in which, the choir-aisles are shorter than the choir, and all are terminated with apses.* I shall have other occasion to point out that at a later date the architects of Ainay and of Le Puy must have been the same. The date of the foundation of Ainay is some time in the ninth century, and it was carried on until the end of the eleventh; but the apse and capitals of the columns of the crossing—for the columns themselves are Roman—cannot, I think, be later than about A.D. 950 to A.D. 1000, which latter would, I think, be the date generally accepted for this portion of the work at Le Puy. To proceed with my notice. The crossing is surmounted by a quasi dome, carried up as an octagonal lantern, much of which has been modernised in restorations, whilst much is quite new; though the universality of the raised central lantern in the churches of the district makes it probable that it is, to some extent, a proper restoration.† The transepts are covered with barrel vaults, strengthened by transverse ribs of a square section below them; the small apses in their end walls have semi-domes, and the tribunes which cross them are groined with quadripartite vaults without ribs. The whole of the nave is covered in the same way as the crossing, each bay being divided from the next by bold transverse arches, and having a quasi dome, supported by arches across the angles of each compartment, and all of them, in truth, being not domes, but eight-sided pointed vaults, springing from the octagonal bases thus contrived. There are no pendentives, properly so-called, and the construction is, I should say, that of men who desired to erect domes, but had no knowledge whatever of the way in which they were constructed in the East: or,—to take a more favourable,—and, perhaps, juster view, of men who, desiring to give a small building the greatest possible effect of space, to roof it with stone (not knowing anything yet about flying buttresses), and to light it from a clerestory, actually solved all these points in a successful way. Where this kind of roof was first attempted I am quite unable to say. Certainly the central lantern at Ainay is so identical in character with some of those at Le Puy, that the same workmen must have executed both; but there seems to be no other example in the same district as Ainay, whereas at Le Puy, and in Vélay and Auvergne, everything was more or less roofed on the same principle. The second portion of the cathedral at Le Puy consisted of the third and fourth bays of the nave, and the third portion of the fifth and sixth bays.‡

The latest portion is of Early Pointed character, and not later in date than circa A.D. 1180 to 1200, and it was at the same time that this was erected that the greater part of the enormous substructure forming the porch was also completed. The aisles throughout the church are vaulted with quadripartite vaults, the three western bays alone having ribs. In the two western bays we see engaged shafts both in the porch and above it in the nave, but the rest of the piers are of the simplest plan, large and generally cruciform in their section, save at the crossing, where the arches are carried on coupled detached shafts. There is much elaborate sculpture introduced in the capitals of the pilasters and columns of the nave, but it is nowhere of any very high merit, and is so inferior in delicacy and beauty to the sculpture of the same age to be seen on the banks of the Rhone, that I

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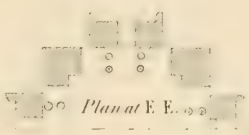
* S. Martin d'Ainay, at Lyons, is a parallel triapsidal church, with a central dome, and a western tower of unusual and picturesque outline, adorned largely with inlaid tiles and bricks.

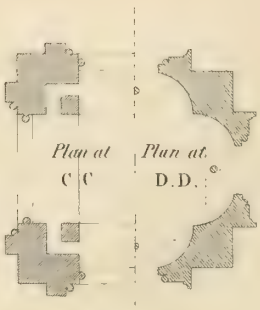
† At present the exterior of the lantern is covered with a domical roof; but an illustration in the "Dictionnaire Encyclopédique" shows it finished with a low-pitched tile roof, and without any of the inlaid mosaic which is now seen on it.

‡ The division of the building into work done at various epochs is beyond question, though there may be some question as to the dates I assign. On the engraved ground plan the dates are indicated by the direction of the lines.

Cathedral of Notre Dame Le Puy.

I. ELEVATION AND SECTION OF STEEPLE
II. GROUND PLAN OF CATHEDRAL AND DEPENDANT BUILDINGS





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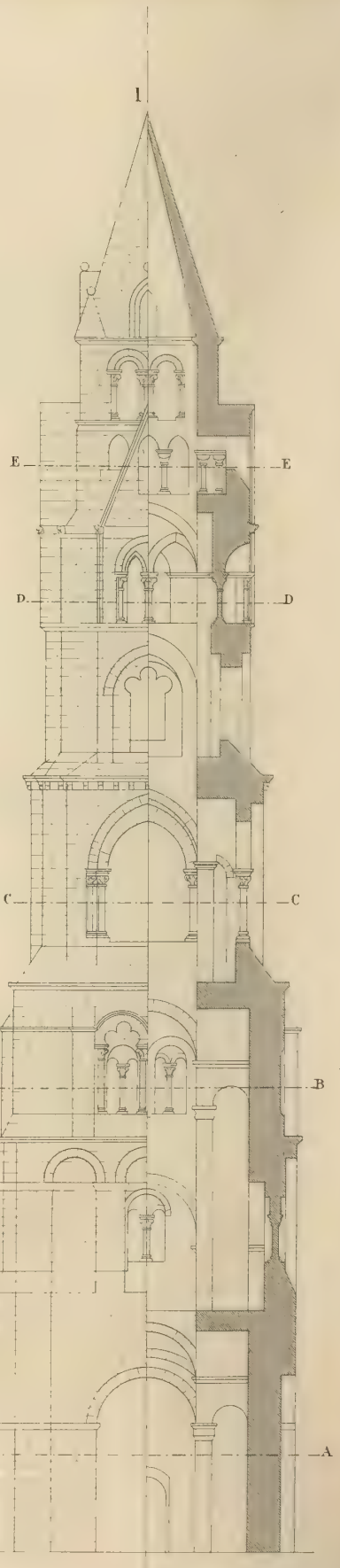
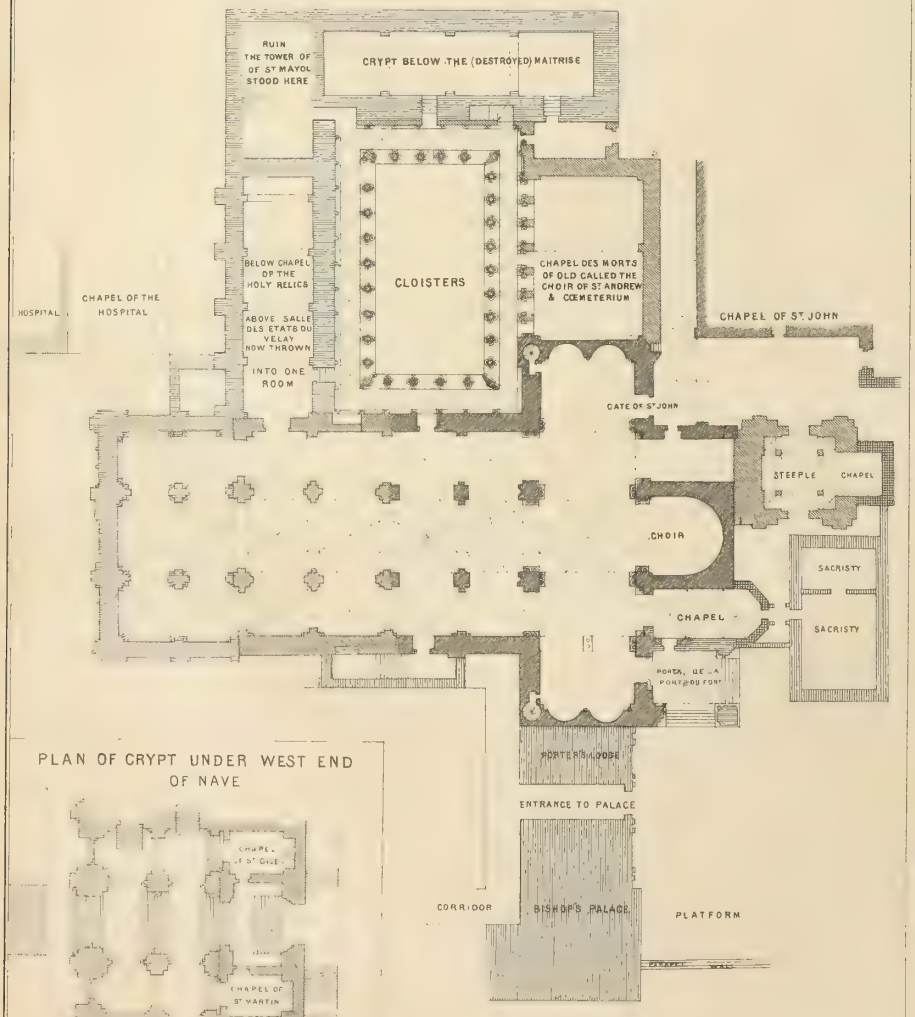
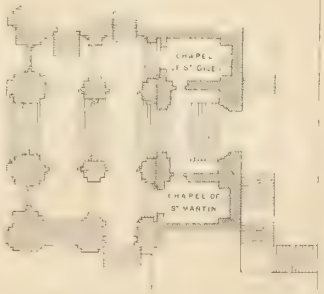


II



PLAN OF CRYPT UNDER WEST END OF NAVE



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should attribute it to a native school of sculptors acquainted, probably, with none but inferior Roman sculpture, from which they endeavoured to develope a style for themselves. A clerestory of wide and rude round-headed windows, one in each compartment, lights the series of domes in a very effective manner.

The arches across the nave are very bold, and, in the wall above them, an opening is pierced under each of the cupolas. As is generally the case, however, in churches covered in this way very little is seen of the real vault in any general view of the church, these transverse arches only with, the quasi pendentives above them being seen. The pendentives are true semi-domes, constructed in alternate courses of dark and light stone, and the difference between their plan and the square angle in which they are placed is skilfully concealed by detached shafts with capitals placed under the pendentives.

I think you will agree with me, when you examine my sketch of the interior, that considering its early date (no part probably later than circa A.D. 1150 or 1180), it would be difficult to find a grander or more nervous scheme, or one which, with such small dimensions, conveys nevertheless so great an impression of size and importance. The choir aisles were altered at various times. That on the south has been rebuilt in Second-Pointed of poor character, and is now a mere passage-way to the modern sacristy, and that on the north was probably interfered with not very long after its first construction, when the great steeple which now abuts upon it was commenced. M. Mérimée,* in his very interesting description of the church, suggests that the base of the tower was originally a baptistery, but I see no reason whatever for this suggestion, and it is impossible to doubt, when one carefully examines the whole design, that though the steeple was long in building, the main feature in its design was from the first just what we now see it to be. Moreover, the chapel of St. Jean close by is said to have been the baptistery for the whole city until within the last sixty years. You will see from my elevation that the design is very bizarre and unusual. It consists of a long series of no less than nine stages on the exterior, and it diminishes rapidly in diameter, and is, perhaps, on the whole, more curious than pleasing in its outline.

If you look at the ground-plan you will see that its construction is most remarkable. The internal diameter of the tower at the base is 24 feet 6 inches, but this is reduced to only 12 feet by four detached piers, 1 foot 10½ inches square. These piers are carried up from the base to the very summit, detached in the three lower stages, and forming part of the thickness of the wall in the portion above. The highest stage of the steeple 12 feet in internal and 16 feet in external diameter, is therefore, as nearly as possible, carried up on these four piers, and the rapid decrease in the external dimensions, from 36 feet to 16 feet, was only rendered possible by this very ingenious mode of construction. So far as I know there is only one other example of the same scheme, viz., in the steeple of the cathedral of St. Etienne at Limoges. Here, however, the base is the only portion remaining of the original work, and the columns are cylindrical in place of being square, but it is evident that the intention was the same as at Le Puy. The steeple at Limoges is probably the first in point of date. M. Viollet le Duc dates it at about A.D. 1050, but the Abbé Arbellot, in a learned paper on the cathedral, in the "Bulletin of the Societé Archéologique et Historique du Limousin," maintains that it was certainly built before A.D. 1012, when the Bishop Arnaud de Perigueux, after assisting at the consecration of Bishop Gerald at Poitiers, accompanied him to Limoges, and put the cords of the bells into his hands. The lower part of the steeple at Le Puy may, I think, safely be

* "Notes d'un Voyage en Auvergne," p. 226.

referred to the end of the eleventh century, and its completion to the end of the twelfth, whilst the planning appears to me to be thoroughly characteristic of a Byzantine artist, the construction of the piers in the lowest stage being almost identical with that of the main piers under the domes of S. Mark's, Venice, and St. Front, Perigueux.

The arrangement of the belfry stage, with its gable on each face, is very noteworthy, and is, perhaps, one of the earliest examples of a type which was developed afterwards into the well-known arrangement of the belfry of the south-west tower at Chartres, and this, combined with the influence of the churches of the Rhine, into almost all subsequent modifications of the spire, with its gabled spire-lights; one of the windows under this pediment is planned in a most ingenious manner, presenting externally a semi-dome pierced by two pointed arches; another window is pierced with a trefoil head, the diameter of which is much larger than that of the light it surmounts. This is a favourite form of cusping throughout this district. I have seen it in Lyons, at Vienne, often at Le Puy, at Brioude, at Notre Dame du Port, Clermont, and in the south porch at Bourges, and there can, I think, be little doubt that it is somewhat eastern in its origin, and analogous to the horseshoe form of arch.

The cloister on the north side of the church appears to be in part coeval with the earliest,* or, perhaps, the second portion of the fabric, and in part with the later additions to it. It consists of a simple arcade of round arches on rather solid piers, with a detached shaft on each face. The capitals are all richly sculptured, some with figures, some with foliage. The spandrels of the arches are filled in with a reticulation of coloured stones; above the arches runs a band of similar ornament, and above this again a carved cornice, which in the later part of the cloister forms a sort of freize. In this portion the arches have sculptured key-stones, a peculiarity which I hardly remember to have met with before in work of the same date. On the south side there is one spiral and two fluted shafts, all the rest are circular, but noticeable for their very considerable entasis. The groining is all quadripartite without ribs, and executed with rough stones, set in concrete, on a centering of boards. The cloister was surrounded on all sides with buildings. On the south is the cathedral; on the east, and opening to the cloister by an arcade of open arches, is a large hall covered with a pointed barrel vault. This was originally called the choir of St. Andrew, and in it masses in commemoration of the dead were said, and services held on the feasts of the Invention and Exaltation of the Cross, and on the feasts of St. Andrew and St. Eustachius. It was also called cæmeterium, being used for the burial of the clergy, and is now called the chapel "des Morts." On the end wall are still to be seen remains of a painting of the Crucifixion, with many prophets and angels, St. Mary and St. John, the sun and moon, &c. In the northern gable of this building is a fine cylindrical chimney built in alternate courses of dark and light stone, and rising from a fire-place in a chamber over the hall, and of the same date as the hall. M. Viollet le Duc gives a drawing of the fire-place, which is of a not uncommon early type, the head projecting considerably on a semicircular plan. At the north end of the Salles des Morts is a passage leading to the cloister, and along the whole northern boundary once stood a vast range of building called the Maitrise.† Nothing now remains of this save its undercroft, which was spanned by bold pointed arches of stone, on which the wooden floor rested. The Maitrise was pulled down a few years since, and, not long before, I find that a tower close by it, called the tower of St. Mayol, was

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* M. Viollet le Duc considers the earliest part of the cloister to date from the 10th century; M. Merimée thinks the 11th century more likely.

† The "maitrise" was, I believe, the school attached to the cathedral.

also destroyed. It was standing in A.D. 1835, but I have been unable to find any drawing of it; it is described as an erection of the eleventh century, battlemented, but without machicoulis.* It seems to have served as part of the fortification of the church, which was also attended to in an alteration of the building on the west side of the cloister, in the fourteenth century. This building contained, below, a hall on a level with the church, which was the chapel of the Holy Relics; above was the Salle des Etats du Vélay, with a stone barrel roof, now both thrown into one room. Above these again was an open space under the roof, protected on the side towards the town by a magnificent overhanging battlement and machicolation of the fourteenth century, and quite open on the side towards the cloister save for the stone piers supporting the roof. The machicoulis are some of the finest I have even seen, and project from the buttresses as well as from the walls. The only access to this stage of the building seems to have been from the roof of the cathedral. Le Puy was, in the first instance, selected as a site for the cathdral, because it afforded so secure a refuge from attack, and in later days it seems to have been not less necessary to provide against danger: for among other enemies the lords of Polignac, a magnificent castle visible from the steeple of the cathedral, and only some four miles distant, were the most conspicuous as they were also the most powerful. M. Viollet le Duc supposes, indeed, that the tower of the cathedral was meant in part for defence, but I see no evidence of this, and possibly he had in his mind the destroyed tower of St. Mayol, which, as well as the double wall of *enceinte*, which formerly surrounded the whole cathedral, was no doubt a purely military construction. Fortified churches are by no means uncommon in this part of France. At Brioude is a painting showing the church entirely surrounded by a crenellated and turreted wall in A.D. 1636, and Royat, near Clermont, and the abbey church of Menat, also in Auvergne, still retain provisions for defence. The Salle des Etats contained formerly the archives of Vélay, and in removing them a few years since (about A.D. 1850) portions of a hanging of blue wool, *semée* with fleurs-de-lys, and adorned with the armorial bearings of Jean de Bourbon, Bishop of Le Puy, from A.D. 1443 to 1485 were found.† At the same time a curious painting on the east wall of the lower chamber was discovered under the whitewash. It represents four liberal sciences—grammar, logic, rhetoric, and music—as females seated with ancient worthies at their feet. Priscian sits below grammar, writing, and two boys with open books on her other side. Logic holds a lizard in one hand and a scorpion in the other, and Aristotle is arguing below. The inscription below is—"Me sine doctores, frustra coluere sorores," and each figure has a corresponding leonine verse inscribed below. Rhetoric holds a file in her left hand, and Cicero sits at her feet. Music plays an organ, whilst Tubal, with two hammers, plays upon an anvil. There used—according to the Chronique de Medicis—to be a second painting here with figures of young demoiselles gorgeously clothed, and from the same chronicle it appears that Messire Pierre Odin, official of the Bishop Jean de Bourbon, who died in 1502, presented both:—"Il estait si grant orateur que par son mellifère et suaviloquent langage, fust commis plusieurs fois estre ambassadeur devers le Pape à la requette de très excellent et redouté Prince Louis XI roy de France, lequel du dict Pape obtint grand louange et avoir, ce que il employa en divers façons et moyens en aulmoines et à la décoration de cette saincte

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* Merimée, Voyage en Auvergne, p. 232.

† It is very difficult to understand precisely where these hangings were found. M. Aymard, a distinguished antiquary at Le Puy, in his Album Photographique, speaks of the painting on the wall of the Salle des Etats, and then, in another place, says that "the tapestries given by Jean de Bourbon served to decorate the Salle des Etats du Vélay, and after the regrettable destruction of that hall the remains of them are preserved part in the cathedral and part in the museum." Possibly he refers to the removal of the floor below the Salle des Etats du Vélay, for the hall itself has not been destroyed.

église du Puy." The picture has very considerable merit; its detail is a mixture of Renaissance and Gothic, and the Gothic portion, as, for instance, the chair on which one of the figures sits, is not Italian, and I should be inclined to suppose that it was the work, therefore, of a French artist. Its date must be between A.D. 1475 and A.D. 1502. Louis XI came to Le Puy on a pilgrimage in A.D. 1475.

The external side elevation of the church is best seen from the cloister, and, with a few words upon this, we will leave this portion of the building. Here, even more clearly than inside, the division of the building into work of different epochs is seen. The two bays nearest the crossing have large coupled windows in the aisle, with party-coloured voussoirs and jamb shafts. The clerestory is very peculiar in its treatment, and undoubtedly very effective; the windows are of one light in each bay and round-headed, and on each side of them above the springing there is a recess in the wall, in the centre of which a detached shaft is placed to carry the cornice. A similar recess and a smaller shaft occur immediately over the arch of the window, and the window arch being built of alternately dark and light stone, and all the sunk panels being filled in with geometrical patterns, composed in the same way, an extremely rich effect is obtained. Recesses of the same kind in the upper part of the walls occur all along the eastern face of the transept at Le Puy, and between the clerestory windows of Notre Dame du Port, Clermont, St. Paul, Issoire, and commonly in Auvergne. But, as far as I can judge from the portion of the cathedral in which it occurs, and from the early and simple character of the work itself, I am inclined to believe that it is earlier here than in any of the other examples. It would be of great interest to have some more positive evidence on this and other similar questions of date. But, so far as I have been able to discover, there is no such evidence, and we are left in doubt, therefore, whether this portion of the architecture of Vélay came from Auvergne, or whether the reverse was the case; as also whether this external decoration of the fabric is coeval with its first erection, or is a subsequent addition.

The two central compartments of the nave have circular windows (16 feet in diameter) to light the aisle, and round-headed windows in the clerestory, and between the arches of the latter windows are small arched recesses. In the two western bays the clerestory is similar, save that the intermediate recessed arch is omitted. In both the voussoirs are counter-changed, and the wall from the springing up to the eaves coursed with stone and lava. The transept gables are only noticeable for the courses of inlaid patterns with which they are enriched. All these patterns are formed with white stone and lava. The latter, indeed, forms the whole ground of the walls, and varies in colour from a greenish grey to black, and the patterns are formed with the darkest lava and stone. The cloister is similarly inlaid above the arches, but it has almost all been restored in a most injudicious manner. They have *struck* and *ruled* (I believe that is the technical phrase for this most abominable of inventions, is it not?) an enormous red mortar joint between all the stones,* and wherever this has been done the diaper appears to be formed with a chequer of black and red; wherever the cloister has not been retouched the diaper is black and white.

I have left, almost until the last, that which is, after all the crowning wonder of this singular church—the western porch. I have already referred to its position and plan. The majesty, I may say the awfulness, of this entrance, can hardly be exaggerated. It owes little to delicate detail or enrichment of any kind, for though these have been they are no longer, and it is the gloom and darkness, the simple nervous forms of arch and pier, the long flight of steps lost in obscurity and

* M. Mallay, of Clermont, says that the mosaic work of the church of Notre Dame du Port, Clermont, was all set in red mortar originally.

crowded constantly (when I saw them) with a throng of worshippers, which constitutes the strange charm of this strangest of entrances. I told you that in the nave the two western bays of the aisle alone had groining ribs; in the porch below it is only in the western bay that they are used, and this affords interesting evidence of the very gradual yet regular development of our art.

The spaces below the aisles in the third bay from the west form chapels—that on the right dedicated to St. Martin, and that on the left to St. Giles. Before the last extension of the building these chapels were at the extreme west end. They have western doorways, and these still retain the wooden doors. Each of these doors was of four divisions in height, covered with subjects carved in low relief. They are executed either in cedar or deal (I am uncertain which, for they are covered with paint), and the subjects, inscriptions, and borders are all obtained simply by sinking the ground 3-16ths of an inch. The figures are all, of course, only in outline, but it is still evident that they were carefully painted with draperies, &c., so as to be thoroughly distinct. There is some appearance of the ground having been painted with broad horizontal bands of colour, but the traces are so indistinct that it is difficult to speak positively. The doors are hung folding, and those to the chapel of St. Giles contain subjects from the early life of our Lord, whilst those in the chapel of St. Martin contain subjects from his Passion. The meeting rail in the former fortunately contains an inscription of extreme value:—"Gaulfredus: me: fct: Petrus: epi"; after which some letters are lost. If my reading of the last letter but one, as P., is correct, I think it leads to a most important inference. No one who looks at the design of these gates can doubt that they are thoroughly eastern in their character, and, upon searching for the list of Bishops of Le Puy since my return, I was delighted to find that the first Bishop of the name of Peter was consecrated at Ravenna by Leo IX in A.D. 1043, and died at Genoa A.D. 1053, as he returned from the Holy Land. Gates of the same description are said to exist in the churches of Chamalières and of Lavoûte-Chilhac* in the same district, whilst other evidence of intercourse with the East is afforded by fragments of tissues preserved at Monestier, at Pébrac, and at Lavoûte-Chilhac. These tissues are all extremely eastern in their character, and very similar to the famous cope at Chinon and to the Le Mans tissue, both of which are described by M. du Caumont in the "A-B-C-daire," and in the "Bulletin Monumentale," 1846 (page 564). The date ordinarily attributed to these tissues is the middle of the eleventh century, and this would exactly tally with the return of Bishop Peter from the Holy Land. I dwell on this the more because, if the inference I have drawn from the inscription be true, it gives the date also to the second portion of the construction of the cathedral, to which the chapels in the porch undoubtedly belong; and the result would be that whilst we should date the earliest portion of the church at about the end of the tenth century, or quite the commencement of the eleventh, the second portion would be dated at about A.D. 1050; and, finally, there is little doubt as to the whole having been completed in the course of the twelfth century.† These dates are, as in all such cases, of course only approximate, and it is pretty clear that there was seldom any long pause in the works, and the development in their architectural features is therefore very gradual.

The external elevation in the west front is similar in style to the clerestory on the north side, and mainly executed in alternate courses of lava and stone. The aisle-roofs are masked by walls with pediments. Throughout this part of the work you will observe that its early date is proved by the fact that the round arch is almost invariably used for ornament, and the pointed arch only

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* The predecessor in the see, Stephen II., and uncle of Bishop Peter I., was buried at Lavoûte-Chilhac.

† A "diploma" of A.D. 1146 is dated from the Ville d'Anis (*i.e.* Le Puy), and fixes the date at which this "cité" received the name of "ville."

where great strength was required. A great buttress, which had been built against this west front, was removed during the recent restorations.

I observed before that there are doorways on the east side of both transepts—the "ears" referred to in the old saying. The south transept door is in itself remarkable for the peculiar form of the cusping of its arch, and still more for the magnificent porch built over it. The date of this is the latter part of the twelfth century. It is open on the south and east sides, and abuts on the church on the west and north, occupying the re-entering angle between the transept and choir aisle. The arch is remarkable for a rib detached below the arch, and connected at intervals with it by columns, so as to have the appearance of being suspended. My impression is that the architect feared that his arch had not sufficient abutment, and hoped by bringing some of the weight on to the lower rim of the arch to remedy this defect. The whole detail of this porch is a very rich kind of pointed, full of half-Romanesque and half-Byzantine detail. The groining, in alternate coloured courses, is quadripartite, but has the very rare peculiarity (in France) of ridge ribs. Above the porch is a room or chapel, to which I omitted to gain access. Over the door of the other (north) transept a great arch, thrown from the cathedral to the chapel of St. John, carries another chapel, lighted with a First Pointed triplet. This door is square-headed, and covered with rich though rude ironwork. The door-handles have a resemblance to one in the cathedral at Trêves made by Jean and Nicholas of Bingen, which struck me, and was remarked on also, I find, by M. Mérimée. The lintel of the door is deeper at the centre than at the sides of the door, pediment like, and has figures of our Lord and the Twelve Apostles carved on it, whilst above, under a circular arch, is another figure of our Lord, with an angel on either side. The whole has been very much mutilated and all the figures hacked to pieces. The ground was all painted, and no doubt the figures were also, and the woodwork of the door was covered with linen or leather under the ironwork.

The very ancient chapel of St. John is close to this door, and by its side is a fifteenth century archway. The chapel is arcaded on its south side and pierced with very simple windows. Some antiquaries assert that it is a piece of Roman construction, and it is not impossible, though I should be much more inclined to call it tenth century work. The chapel has a rude quadripartite vault, and its apsidal chancel is roofed with a semi-dome. It was until A.D. 1791, the baptistery for the entire city, none of the churches in which seem to have possessed fonts.

I must conclude my already long notice of this church by some mention of the extensive remains of painted decorations still visible. During the late restorations of the cathedral I understand that the greater portion were destroyed.* The north transept vaults and the semi-domes of its apsidal recesses are still, however, covered with paintings, though they are scarcely intelligible now owing to darkness and dirt. In one of them occurs a figure of our Lord giving the benediction in the Greek fashion, and it is one of the many evidences which may be adduced of the eastern influence visible here in so many respects, though I am not disposed to lay so much stress upon it as some of those did who engaged in the controversy it occasioned.† In the western porch there are also extensive

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* I gather this from what M. Aymard says.

† See M. Aymard's "Album Photographique d'Architecture Religieuse," and a communication from the same gentleman in the "Bulletin Arch.," vol. ii. p. 645. M. Aymard mentions one other example, a dyptych, figured in Montfaucon, vol. iii. p. 229, which dates from about A.D. 900. The hand at Le Puy is larger than life, and has a double nimbus round it, the inner yellow, the outer dark red, the hand is white, and the ground within the nimbus dark blue. The Secretary of the Comité Historique considers that this representation of the Greek mode of giving the benediction makes it certain that the work at Le Puy is Byzantine in its origin. But one may, I think, be allowed to doubt whether this conclusion is to be absolutely depended on.

remains of painting; the soffits of the arches in the third bay from the west are all painted, and so too are the walls over the altars in the chapels of St. Martin and St. Giles. The painting was executed on a thick coat of plaster, and the nimbi are of gold with lines incised on them. No doubt the whole church once glittered with gold and colour, and seeing how fine its effect still is we may, aiding the indications still left with our recollections of St. Mark's, of Assisi, and of Padua, people the bare walls once again, and bring before our eyes an interior of the most gorgeous magnificence.

I may conclude what I have to say about the cathedral with a few words about the sacristy and its contents. The building itself is not more than 150 years old, and most of its treasures have been lost. The most precious relic still left is the Bible, recorded by a note at its end to have been written by St. Théodulf, Bishop of Orleans, in the ninth century, and sent by him, in accomplishment of a vow, to the shrine of Notre Dame du Puy. It is a 4to. of 347 leaves of very fine vellum, some white with black letters, and others purple or violet with gold or silver letters. It contains the Old and New Testament, commentaries on the text, interpretations of Hebrew, Greek, and Latin words, and some poems by Théodulf. The pages are interleaved with excessively delicate tissues of various colours and patterns, which appear to be of the same age as the book, and of eastern manufacture. They are made of china crape, cotton, silk, linen, poil de chèvre, and camel's hair, of extreme fineness, and of various colours and patterns.* The binding is, however, later, and of red velvet on chamfered oak boards, with good simple metal knobs. There are also preserved here some wax candles, tapering considerably in their length, and stamped with a pattern made by a pointed instrument; and, finally, there is a tippet said to have been of Charlemagne's time; it is embroidered with a tree of Jesse. It is not so old as is said, but may possibly be (though I very much doubt it) of the twelfth or thirteenth century, but it has been much damaged by removal from its original ground and by partial re-working. They also have a reliquary of very late sixteenth century date, of which a photograph has been published by M. Aymard, but which was not shown to me. There is also an almost endless roll of vellum illuminated with a chronological tree of the history of the world.

How much has been lost may be guessed from some statistics which I have come upon as to the number of silversmiths and specimens of their work in Le Puy in the middle ages: in A.D. 1408 there were no less than forty resident in the city, whilst as to their work I find that in A.D. 1444 there were in the sacristy 33 chasses and reliquaries, 26 chalices, 11 statues of the Blessed Virgin Mary, angels, and other figures, 10 candelabra, 9 crosses, 9 lamps, 9 mitres, crosses with their stems, episcopal rings, crowns for the Virgin, censers, paxes, basins, plates, books with covers adorned with chasings, pearls and precious stones, and many like things. And in A.D. 1475 I find that Louis XI gave 30 silver marks for a canopy over the miracle-working figure of Notre Dame du Puy, which was made by Francis Gilbert, a silversmith of Le Puy. Other churches in the neighbourhood have been more fortunate in retaining some of their old plate, and a fair list might be made out, if I had time, of their possessions, many of which have been photographed by M. Aymard.

The building of the greatest interest, after the cathedral, is the little church of St. Michael, which crowns the enormous rock fitly called the Aiguille. It is reached by steps winding irregularly round the rock, to the shape of the summit of which it has been most ingeniously adapted. The oldest portions of the building is the square choir, covered with a dome, under which stands the principal altar. To the (ritual) east and north of this are apsidal projections, and to the south an archway, which, as it agrees exactly in dimensions with the others, opened, no doubt, into a third apsidal chapel, like the others, whilst the entrance was at the west. This archway now leads into a

* M. Aymard.

chapel of very irregular form, part of which extends over the porch of entrance, in the arrangement of which one may trace a certain kind of analogy to that of the cathedral, though it is perhaps older. West of the choir is a nave, somewhat like a cone in plan, and surrounded by an aisle, from which it is divided by arches supported on slender shafts. The choir has a square domical vault, and the chapel over the porch a true dome, the pendentives under which are just like those of Sta. Fosca at Torcello. The apsidal chapels have semi-domes, and the rest of the church has a waggon vault of very irregular outline. An arcade against the walls of the aisle corresponds with that between the aisle and the nave. At the end of the nave is the tower, which was probably built at a slightly later date than the main building. The whole interior appears to have been richly painted, but faint indications only of this portion of the decoration remain. In the central dome there is a sitting figure of our Lord on the east side, the emblems of the Evangelists at the angles, and angels and seraphim around our Lord. Below these is a line of single figures, six on each side—the four and twenty Elders—and below this again are subjects, the whole combining together to make a very interesting example of the treatment of the Last Judgment. The dome of the chapel over the porch is also painted with our Lord, Angels, and the Evangelists.

The walls generally are built of lava, though a little white stone is used in the steeple and for the sculptured capitals.

The columns are very small, averaging 8 inches in diameter, and decrease considerably in diameter from the base to the capital. The dimensions are exceedingly small, the central choir being only 13 feet 6 inches in diameter, and the spaces between the principal columns in the nave varying from 4 feet to 4 feet 9 inches. The effect is rather that of a crypt, but, in spite of its small size, it is solemn and religious.

The steeple suggests comparison, in some respects, with that of the cathedral; the arches are built with alternately light and dark voussoirs, and there is a peculiar spire-light rising out of the parapet, as to the antiquity of which I have my doubts.*

The only part of the building in which any rich decoration has been introduced is the front of the porch. It has a semicircular arch, trefoiled above a horizontal lintel. The walls are richly inlaid, and there is also a good deal of sculpture. In the centre division of the trefoiled tympanum is an Agnus Dei, and there are figures kneeling and holding chalices within the cusps on either side. In the five divisions of the arcaded cornice are—in the centre our Lord, on his right St. Mary and St. John, and on his left St. Michael and St. Peter. The mosaic is executed with black tufa red and white tiles, and a light yellow sandstone. I know no other example in this district of the use of tiles for inlaying, though M. Mallay mentions one at Merdogne in Auvergne, which he says is of the seventh century; but his dates are not always to be implicitly trusted; but at Lyons, in the extremely beautiful Romanesque domestic building called the Manécanterie, and at a slightly later date in the church of Ainay, in the same city, they are freely used and with admirable effect. Odo de Gissey, in his history of Le Puy, published in A.D. 1619, states that the first stone of St. Michael was laid in A.D. 965, and that the church was completed in A.D. 984, when Guy II. was Bishop of Le Puy, "as one may learn from the ancient charter of its foundation, and from other manuscripts which I have read." Brother Theodore in his "Histoire de l'Eglise Angelique," in A.D. 1693, says that the first stone was laid in August, 962, and that his statements are "derived from the deed for the foundation of the church, and from the book of obits in the cathedral."† These dates,

* The spire lights in the cathedral steeple are very similar, and the same form is seen again in the steeple of the little church of St. Marie des Chazes in Auvergne.

† Quoted by M. Mérimée, Notes d'un Voyage en Auvergne, A.D. 1838.

if they refer to the existing building, can only do so to the central portion with its apses, and the nave may have been added some time in the eleventh century, and the steeple, perhaps, in the course of the twelfth.

At the foot of the flight of steps which leads up to the picturesque entrance of this little chapel are the remains of a small detached building, probably a residence for a sacristan or priest.

Very near the Aiguille de St. Michel is a curious chapel. It is an octagon, with an apse projecting from the eastern face, the octagon covered with an octagonal domical vault, and the apse with a semi-dome. The walls are arcaded inside and out below the vault, the internal arches springing from engaged shafts in the angles. Some of the arches outside are cusped in the usual way, the cusping not starting from the cap with a quarter circle but with a half circle, the same as all the rest. There are doors in the west and north sides, with tympana filled in with mosaic, and the wall in the spandrels between the arches outside is also inlaid. The exterior of the apse is not visible, but I found, on making my way into the cottage and barn built against it, that it is perfect and undamaged. The popular opinion at Le Puy is that this chapel is an ancient temple of Diana, a fiction which a minute's examination destroys. M. Didron, in the Bulletin du Comité Historique, No. 7, p. 62, maintains that it was a mortuary chapel: this is, he says, a common arrangement in Greece, and he refers to the Chapel of St. Croix, at Montmajour, as an example akin to this. M. Mérimée, on the other hand, says that the Templars had property in the Faubourg de l'Aiguille, and compares it to the similar oratory of the Templars at Metz, and he might have added the curious Templars' church at Laon as another case in point.

This concludes my notice of early buildings in Le Puy, and I have no more than time to catalogue the Church of St. Laurence, famous for the monument of the Constable Du Guesclin; it is a large second-pointed building of poor character, and very Italian in its plan and design,* and with an enormous sham front; the gable end of the hospital chapel, with its fifteenth century bell-turret; a pretty little fountain in the Rue du Portal d'Avignon, a large number of picturesque houses of the fifteenth and sixteenth century; and a very scanty remnant of a gateway at the bottom of the town, called, I think, the Porte Panessac, and against the proposed destruction of which I find M. Aymard protesting only a few years back in the Bulletin Monumentale.

About four miles to the north of Le Puy, close to the ruins of the magnificent castle of Polignac, is the Romanesque church of the village. This is parallel-triapsidal in plan, and the piers are planned, as are those in the Cathedral, in the shape of a cross, with columns in the re-entering angles.

The little church at Monistrol is a good example of the Le Puy type applied to a very small building, and the church at Monestier, which has many features of similarity to the cathedral at Le Puy, and is rich in early plate, ought not to be forgotten. I am unable to speak of it from personal inspection.

I will now take you to the churches of Auvergne. It seems bold to do so at this period of the evening, but in point of fact, though they are numerous they are so much alike in their character, details, and design, that a description of their peculiarities need not be so long as might be supposed.

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* The elevation of one bay of the nave of this church is almost exactly the same as that of San Petronio, Bologna; though of course on a very reduced scale. The plan is Italian also, the nave groining compartments being square, whilst those of the aisles are very oblong; the contrary arrangement is, as I need hardly say, almost invariable in Northern Gothic plans.

These churches all lie in a group together, Clermont Ferrand being their geographical centre,* and to its north are Riom, Volvic, Menat, Mauzac, and Ennezat, to the east Chauriat, to the west Royat and Orcival, and to the south St. Nectaire, St. Saturnin, Issoire and Brioude.

Beyond the bounds of the province, at Conques, at St. Sernin Toulouse, and in the Church of St. Etienne at Nevres, among many others, we have examples of precisely the same description of design and construction. †

It will be well to describe the general type of these churches, and then give a few notes as to particular examples. In plan they consist of a nave and aisles, western narthex and steeple, central dome and steeple, transepts with apsidal chapels on the east, and apsidal choirs with the aisles continued round them, and four or five apsidal chapels round the aisle. Under the choir is sometimes a crypt, in which, in addition to the columns under the columns of the apse, are four shafts which were intended for the support of the altar, and whose presence certainly seems to suggest that it must have been a baldachin and not merely an altar that they were designed to support. ‡

The naves are roofed with waggon vaults, either with or without cross ribs below them. The aisles have quadripartite vaults without ribs, and the triforia above them are roofed with a continuous half-barrel vault, which, as you will see by reference to my sections of Notre Dame du Port, Clermont, resists the thrust of the vault of the nave, and is, in truth, a continuous flying buttress. The triforia galleries are lighted with small windows, and this, the only light analogous to a clerestory, being entirely inadequate, the effect of the nave roof is generally very gloomy. The transepts are vaulted with barrel-vaults as the nave, and in one or two instances are divided in height by a sort of tribune level with the triforium. At Brioude, where this arrangement is seen, there is an original thirteenth century open fire-place in the tribune, and M. Mérimée ingeniously suggests that the noble canons of Brioude—for they all had the rank of Count—were in the habit of hearing mass before a good fire, but it is fair to them to say that the fire-place is in the east wall, and that I saw no sign of an altar near it. The "crossing" under the tower is generally roofed either with an octagonal vault or with a circular dome with an opening in the centre. To resist the thrust of this dome on the north and south sides the upper vaults of the triforia are continued on between the transepts and the crossing, or else vaults of the same section are introduced at a higher level, where the central dome is raised (as it often is) higher than the barrel-roof of the nave. The western steeple, as well as the centre lantern, was sometimes, at any rate, domed; and that at Brioude

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* The Cathedral of Clermont-Ferrand, a fine fourteenth century church, is said to have been originally on the same plan as Notre Dame du Port; excavations have proved this to have been the case. The present cathedral is almost precisely similar in plan to those of Narbonne and Limoges.—See Viollet le Duc, "Dictionnaire," and is said to have been commenced in A.D. 1248 by Bp. Hugues de la Tour.

† I give a list of some of the churches, which either belong to or illustrate the Auvergnat type, with their dates, as nearly as I can ascertain them:—Conques, completed by A.D. 1060. S. Etienne, Nevers, commenced A.D. 1063, consecrated A.D. 1097. S. Eutrope, Saintes, consecrated in A.D. 1096. S. Genes, A.D. 1016—A.D. 1120. S. Front, Perigueux, A.D. 984 to A.D. 1047. Angoulême, A.D. 1109—1136. Fontevrault, A.D. 1100. S. Hilary, Poitiers, A.D. 1049. Montierneuf, ditto, A.D. 1069—1096. S. Radigonde, ditto, A.D. 1099. Riom (St. Amable), A.D. 1077—1120. S. Senim, Toulouse, (circa) A.D. 1150. Cluny, commenced A.D. 1089; consecrated A.D. 1131. Dorat (Hte. Vienne) and Bénévent (Creuse) circa 1150—1200. S. Germain des Pres, consecrated A.D. 1163. Le Montier (Suburb of Thiers), 1016. St. Saturnin, Volvic; Issoire, St. Nectaire; N. D. du Port, Clermont, circa 1080—1160. Brioude, circa A.D. 1200. Orcival.

‡ S. Gregory, of Tours (Hist. Francorum) says that in A.D. 440 a church was erected in Clermont by the Bp. Namacius, 150 feet in length, 60 feet wide, and 50 feet high to the vault; from the seat of the Bishop a circular gallery surrounded the choir, and on each side were two aisles elegantly constructed. The church was in the form of a cross, had 42 windows, 70 columns, and 8 doors; its walls were adorned with mosaics of various marbles, quoted by M. Branche, "L'Auvergne au Moyen Age."

is a most valuable example of the best type of dome in the district. The choirs are vaulted with waggon-vaults terminating with semi-domes, and the apsidal chapels are also each covered with a semi-dome. The columns are generally square, with half-columns engaged on three, and sometimes on four sides, the latter only when the main vault of the nave has transvere ribs below it. The columns round the apse are circular, and detached shafts against the apse walls carry the groining, and occasionally shafts are introduced inside and outside the window-jambs of the choir. In the nave and triforia, the windows are generally very plain, with a label containing a billet moulding, though the latter have sometimes, as at Notre Dame du Port and Issoire, jamb shafts. The capitals of the columns are carved with great richness, sometimes with foliage, but often with Scripture subjects. At St. Nectaire, for instance, perhaps the most elaborate of all these churches in this respect (M. Didron is my authority), the capitals round the apse have subjects from the New Testament, four on each capital. Frequently griffins and other animals are carved, and in one case, at Brioude, is a demon holding an open book on which is written the sculptor's name, which does not seem to be a very complimentary arrangement. It is in the earlier examples that sculpture of subjects and figures is commonly seen, and as the style developed more towards Gothic, foliage took the place of subjects. The arcades are remarkable for their generally lofty proportions. They are of course not so lofty as pointed arcades, but they have seldom, if ever, the heavy and low proportion commonly found in the arcades of Romanesque buildings. The arches are generally semicircular, and in the apses stilted.

The walls were probably covered with paintings of Scripture subjects. At Brioude there is some of this decoration remaining in a chapel dedicated to St. Michael, in the gallery over the narthex. The semi-domes of the apsidal chapels in this church were also richly painted, and in one of them traces of colour exist all over the window jambs. At Notre Dame du Port, Clermont, in cleaning the nave, after removing seven or eight coats of whitewash, considerable traces were found of gilding on the capitals, and if this portion of the church was thus highly decorated, there can be no doubt that the colouring of the choir was at least equally sumptuous.

A stone seat is in some cases continued all round the walls of the apse and its chapels inside and out, and in one or two cases the iron grilles still remain. The only instance of the old pavement that I saw was at Brioude, where it is composed of black and white stone in checquers, but this is a mere fragment and of poor design.

The entrances to the crypts are by stairs from the transepts or "crossing." The staircases to the upper portion of the building are variously placed. At Notre Dame du Port they are in the middle of the north end of the aisles; at Brioude, in the transepts, and also at the west end; and in this church, an enormous wooden stair leads from the south door up to the chapel of St. Michael over the narthex.

On the exterior the designs are as much alike as in the interior. The aisle-walls are divided into bays by pilasters, above which arches are turned above the aisle windows, and then above are the windows lighting the triforia, which are generally more richly decorated than those below, and form part of an arcade with carved capitals and moulded bases. The walls are finished by a boldly projecting cornice supported on large corbels. The transepts are buttressed at the angles, have a heavy engaged column in the centre, from which two arches spring, within which are pierced two windows; above these are other windows—either two or three lights—and the gable is either filled in with mosaic or pierced with more windows. It is on the exterior of the apse that the main effort at display is made, and the more ornate examples of the style, as Notre Dame du Port, Issoire, and

Brioude are singularly rich in their effect. The two former examples are of very nearly the same date (about A.D. 1080 to A.D. 1130) the latter is considerably later (probably circa A.D. 1200). I will describe Notre Dame du Port first. Here the transept chapels are much lower than those of the chancel, and the latter (four in number), have cornices below the cornice of the aisle, and gable walls are raised on the aisle walls to receive their roofs, which would otherwise run back to the clerestory. There are windows between each of the chapels, and a great part of the beauty of the effect, both internally and externally, is to be attributed to this fact. I am not sure that the whole arrangement is not a modification of the original plan. For on close examination I found that the labels of the large windows between the chapels are returned and mitre with another label against which the chapels are built, and which might very well have formed part of an arcade pierced at intervals with windows. In the neighbourhood, about half-way between Clermont and Issoire, at St. Saturnin, we have a church precisely similar to what this would have been without its chapels, and the eccentric position of the chapels at Notre Dame du Port, there being none opposite the centre,* would be just such as would have been rendered necessary if it had been desired to add them after the work had progressed somewhat towards completion. In any case, however, there could not have been any great interval of time between them, and probably the chapels and the clerestory are of exactly the same age. The whole of this apse is full of beautifully inlaid patterns, made with red and black scoriæ and white stone. The enrichment is always confined to the walls above the springing of the windows, and does not generally extend quite to the cornice. The spaces between the corbels under the cornice are inlaid, and the under side of the cornice is carved with a sunk pattern, and in some cases appeared to me to have been coloured.

Between the clerestory windows is precisely the same arrangement of shafts supporting a flat lintel under the cornice that I described to you in the first portion of the clerestory of Le Puy, and here, as there, the recessed wall is all inlaid.

At Issoire the general scheme is precisely similar. Here, however, a square chapel juts out from the centre of the apse, and the question arises whether this is an original arrangement. The suggestion I should throw out here, as at Clermont, would be that this is the only original chapel, and that the others were added just as those at that place may have been. In both these churches the buttresses are alternately rectangular and circular, and the latter are always finished with carved capitals. St. Julien, at Brioude, is an example of a later date, but it adheres closely to the same type, save that there are five apsidal chapels, and though the windows are much more elaborate, having jamb shafts and moulded arches, and being arranged in a regular arcade of triplets in the clerestory, there is much less positive effect of decoration owing to the comparatively small amount of inlaying.

The churches at Brioude and Issoire are both on a much larger scale and generally finer than Notre Dame du Port.

Lastly, I come to the steeples of these churches: of these there were generally one or two at the west end, and one over the crossing. I believe that not one of those over the narthex now remains, though two or three have been recently rebuilt. Those at the crossing were treated in a singular manner. The eastern wall of the transept carried up much above the height of the walls of the apse,

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* St. Hilary Poitiers and Angoulême Cathedral have only four chapels.

forms an enormous mass for the support of the steeple, and is arcaded and pierced with windows or inlaid. The steeples seem generally to have been octagonal and to have consisted of two stages arcaded and sometimes shafted at the angles and capped with stone spires sloping at an angle of about 60 deg. The steeple at Issoire is quite modern, and I believe no authority existed for it. That of Notre Dame du Port is also new, the finish having been a bulbous slated erection, with an open lantern at the top, only a few years ago. Ancient examples, more or less perfect, still exist at St. Saturnin, Ennezat, Orcival, St. Nectaire, and Huret, and all of these are octagonal. These churches tally with most other early churches in this feature of central steeples. This is not the time for discussing the question how far the later French architects were right in so steadily refusing to follow the example thus set them. But we may be well satisfied as Englishmen in the opposite course which our architects took, for our greater churches no doubt owe no small portion of their dignity and character to the almost constant recurrence of the central steeple.

I have not yet mentioned the roofs. In those which I was able to examine, they are covered with slabs of stone, supported from the stone roofs without any use of timber whatever. The ridges are also of stone, elaborately carved, and the whole construction seems to be as imperishable in its scheme as anything I know of the kind.

If I were to tell you a great deal more about these churches of Auvergne, I should be able to add but little to what I have said; they present so little variety and were built within so short a space of time, that a description of each of them in succession would be wearisome to a degree. Of course there are some variations. St. Amable, at Riom, for instance, has the main arches pointed, whilst the triforium arcade is round arched, and the vault of the nave is also pointed instead of round. The vault of the nave of Issoire is another example of a pointed vault. At St. Nectaire the usual piers in the nave have given way to columns. At Brioude the style reached its perfection, and, indeed, I know few effects more striking in every way than that of the aisles round the choir; the roof constructed as a regular barrel vault and without any ribs, seems to be as true in principle, and to carry the eye on even more agreeably than our ordinary Gothic vaulting of circular aisles, in which the eye is often distracted by numbers of conflicting lines of ribs. The wall arcades between the chapels recall the peculiar form of trefoil to which I have before had to refer, and we meet it again in the triforium of the south side of Notre Dame du Port.

The doorways appear to be of two types; one enriched with sculpture, the other with inlaid work. Of the former the south door of Notre Dame du Port is a fine example. The opening is square, covered with a pediment-like lintel, on which are sculptured in low relief the Adoration of the Magi, the Presentation in the Temple, and the Baptism of our Lord. Above the lintel is a round arch, under which is a figure of our Lord, seated with a seraph on either side. Against the wall, below the lintel on each side of the door, are figures of Isaiah and St. John the Baptist. In the much-altered church at Mauzac,* near Riom, is a door of somewhat similar kind, and both are very like the doorway in the north transept of Le Puy; at St. Nectaire is an example of a door, with the tympanum filled in with mosaic.

The masonry is usually of wrought stones squared, but not very neatly put together. M. Mallay, the architect of Clermont, who has restored some of them, ascertained the curious fact that the stone-masons who wrought the stone for the arches, and wherever else superior work was required, marked

* At Mauzac is a magnificent shrine of copper enamelled, and at St. Nectaire a variety of precious relics—crosses, reliquaries, and the like, of which M. Mérimée has given a list.

their stones with the usual masons' marks, whilst those who wrought the stones for plain walling, jambs and quoins, made no mark; and he found that precisely the same masons' marks occurred at Issoire and Notre Dame du Port; whilst the details and plan of Orcival, a few miles south-west of Clermont, are again so identical with both of these, as to leave little room for doubt that it was executed by the same workmen; and I found another evidence of the way in which details were repeated, in some fine ironwork on the south door of Brioude, which is repeated again at Orcival.

The arches are generally built with small stones of the same size and of even number, so as not to allow of a keystone. M. Mallay says that the mosaic work in the walls of these churches had wide joints of red mortar, projecting from the face of the wall. These mortar joints in the restored work appeared to me to be a bad modern device, and I think that the evidence in their favour ought to be very strong to be convincing.

The proportions of these churches are very similar. At Issoire, the width from centre of aisle wall to centre of nave column is one-fourth of the whole width, equal to the width from centre to centre of nave columns, and to the diameter of the chapels in the apse, and one-half the height of the aisle, and one-fourth that of the nave. The height from floor to ridge is equal to the extreme width at base of walls. At Notre Dame du Port, the same kind of proportion exists, but from the outside of buttress to the outside of the nave pier is one-fourth of the whole width.

I must now, before I conclude, say a few words as to the date of these churches, for which M. Mallay* is inclined to claim rather too great an age. He dates most of them (but conjecturally) in the tenth century, though he admits that buildings in which the pointed arch is introduced may be as late as the twelfth century; and, indeed, in a paper by him read before this Institute in A.D. 1839, I find that he considers the date of Notre Dame du Port, Clermont, as circa A.D. 863 to 868. He founds this belief on the fact that no lava was used in its construction, and that the mosaics in its walls were formed of scoriæ found on the surface of the soil. He considers that lava was not used until the eleventh century, but he must also prove (which he has not done) that stone was never used in Auvergne after the use of lava had once been admitted. M. Mallay depends no doubt to some extent on the admitted date of the nave of St. Amable, at Riom, where the main arches are pointed, in A.D. 1077. But the presence of the pointed arch proves nothing as to date, for we see it long before this in St. Front, at Perigueux, and in every other respect there is no doubt that St. Amable presents every evidence of being older than Notre Dame du Port, and others of these churches, in which none but round arches occur.

On either side of Auvergne we have other churches, of precisely the same character, as to plan and mode of construction, and of which the dates are pretty certain. One is St. Etienne, at Nevers, which was commenced in A.D. 1063, and completed and consecrated on the 13th December, A.D. 1097. You will see by the plan of this church that it is similar in nearly every respect to the Auvergne churches. But so far as one may judge of date from style, I should have no hesitation in saying that this church must be older than either Issoire or Notre Dame du Port. It is ruder in character, there is very little sculpture on the capitals, which are mostly a sort of rude imitation of Doric, and in the transepts there are not only round arches, but also some straight-sided.

At Conques, south of Auvergne, is another church on the same plan as St. Etienne, Nevers, in almost every respect, which there is little doubt was completed in the first half of the eleventh century, by the founder, Abbot Odalric. Then again to the west we have the church of Montierneuf,

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* Essai sur les Eglises Romanes et Romano-Byzantines du département du Puy-de-Dome-Monlins, 1838.

Poitiers, commenced in A.D. 1069 and consecrated in A.D. 1096, which has a chevet evidently formed upon the same type as Conques. And at St. Hiliary, in the same city, consecrated in A.D. 1069, whilst the ground-plan of the chevet is just the same as that of Conques, the nave columns are strengthened by a transverse arch, similar in its purpose to a flying buttress, and analogous, therefore, to the half-barrel vaults of the triforium in Auvergne. Now none of these churches are earlier than the beginning of the eleventh century, and yet it is hardly credible that a province shut in as Auvergne is, should have received a perfect and complete new style or invented one, and carried it to the degree of finish and perfection at which it had arrived when Notre Dame du Port was erected, without our being able to trace, somewhere, the source from which it was developed. I believe, however, that its origin may be traced if we examine carefully the architecture of the church of St. Front at Perigueux, commenced in A.D. 984 and completed in A.D. 1047. This church, founded on the same type as, if not copied from St. Mark's, Venice,* exercised a vast direct influence on the architecture of the day, as the map which I have prepared will show. It is seen most clearly in churches which are, like itself, cruciform, without aisles and covered with domes. The churches of Auvergne and those other examples of the same kind to which I have referred, seem to me to be clearly derived from St. Front, or from the Eastern models on which it too was founded. The east end of St. Mark's presents us with a circular wall, with a succession of semicircular recesses or apses in its thickness. Sta. Sophia contains the same feature though differently treated.—The Roman circular buildings which have so much in common with Early Byzantine architecture have the same feature; and San Vitale, Ravenna—whether it is Romanesque or Byzantine in its origin—is planned in a similar way. The architect of St. Front evidently copied his apse from these models, only converting the recesses of St. Mark's into chapels projecting from the walls. The Auvergne architects attempted to combine the plan of the basilica with its nave and aisles, with the features which were seen at St. Front. They retained its external wall and projecting chapels, therefore, but placed within them the cluster of columns round the apse forming an aisle between the chapels and the choir. By this simple and natural modification of the St. Front plan to meet the necessities of their triple-aisled churches they at once invented, one may almost say, the perfect French chevet. I know no other churches in France of the same age, which appear to have suggested so much in this respect; and you will realise it if you compare their plans with, among others, those of Bourges Cathedral, St. Pierre Bourges, St. Martin Etampes, Chartres Cathedral, the destroyed church of St. Martin at Tours, and finally what is, I think, almost the best complete Gothic plan, that of Rouen Cathedral; in every one of which we see the surrounding aisle, lighted by windows between the chapels, and the chapels distinct and well separated on the exterior, precisely as in these older churches in Auvergne. These buildings, therefore, have great value, not only as illustrating a chapter of the history of our art, but because the chapter which they do illustrate, is just one of the most interesting we can conceive; being that which explains how and by what steps that Gothic architecture of which, as our national style, we are so justly proud, was developed from the noble architecture of the old Romans and Greeks; an architecture to which we owe, among other things, this great debt of gratitude, that it naturally led up to and rendered possible a Westminster, a Chartres, an Amiens, and all the other glories of our Christian architecture.

You will have gathered from what I have said that there are many similar features in the churches of the two provinces which I have been describing. They are shortly these; vaults and quasi-domes alike, and carried on the same kind of squinches or pendentives; the decoration with

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* St. Mark's, Venice, was commenced in A.D. 977.

mosaics and its detail; the design and treatment of doors, either sculptured or inlaid; the form of trefoil cusping of arches, character of mouldings, sculpture and decoration with painting, all of these are the same throughout both districts; and the only marked difference—and it is important—is in the ground plan; the Cathedral of Le Puy having no chevet, but an east end derived from Romanesque rather than Byzantine precedents; and the other churches in its neighbourhood being generally similar in their plan.

I feel that I am trespassing seriously on your patience, but there are still two important heads of my subject to be shortly discussed before I conclude. One of them refers to roofing, the other to coloured decoration. First, as to roofing. I have already explained how this was executed; let us now consider why the modes which we see were adopted. At St. Front the experiment was tried of covering a nave and transepts with a succession of domes resting on pendentives, and supported on pointed arches spanning the nave. These domes were the only covering of the church, and were visible on the outside as well as on the inside. At Conques, the architect, unable to carry domes on the comparatively delicate piers which were all that were required for the division of a nave from its aisles, contrived a barrel vault for his nave, the thrust of which was resisted by the half-barrel vault of the triforium; a device not improbably obtained from Byzantine churches: for if we compare the section of Santa Sophia with that of the crossing and central dome of Notre Dame du Port we shall find the semidomes affording abutments for the great domes in the former, absolutely identical in their section with the half-barrel vault, which forms the abutment on the north and south sides of the central dome of the latter.* But it was impossible to obtain any light for a clerestory roofed and supported in this fashion, and one is rather disposed to wonder how it was that so many churches should have been built on the same gloomy scheme. It was, no doubt, because in that part of France wooden roofs were thought to be undesirable, and no other economical way was seen of combining the nave and aisles with what was intended to be an indestructible stone roof. I need hardly say that at the same period in the North of France, in Normandy, and in England, the nave was seldom, if ever roofed with anything but timber, and the aisles only were vaulted in stone.

At Tournus, on the Soane, another device was adopted to serve the same end as the Auvergne roof, but admitting of a clerestory: this was the covering of the nave with a succession of barrel vaults at right angles to the length of the church, and supported on bold transverse arches. But I doubt whether it was ever repeated on a nave, though there are several examples of aisles thus roofed;† and it was, no doubt, ugly and ungainly. The Le Puy architect devised yet another plan, which combined to some extent all the others, and this was, as I have explained, a succession of domical vaults, which, whilst it was much lighter and more practicable (owing in part to the difference of scale) than the St. Front plan of a series of genuine cupolas, achieved, nevertheless, much of the effect that was there gained. A very small portion only of the weight of the vault exerted a direct lateral thrust, and it was possible, therefore, to erect such a roof upon a clerestory; and though the transverse arches limit the height of the building in one respect, in another there is no question that the height is apparently much increased; for in looking down the interior it is impossible ever to see the apex of any of the domes, and the vault lost behind the transverse arches gains immensely in mystery and infinity, so as to produce the effect of a larger and loftier building than the reality. But, on the other hand, the disadvantages were great: the piers between the nave

* Mr. Fergusson gives a section of a church at Granson on the Lake of Neufchatel, in which the aisles and nave are roofed in the same way as at Conques and in the Auvergne churches. He says that the date of this church is the end of the eighth or beginning of the ninth century, but I do not know what his authority for this very early date is.

† The Abbaye aux Hommes, Caen, has its aisles roofed with transverse barrel vaults.

and its aisles were so large as to render the aisles nearly useless; and I can hardly wonder, therefore, that the examples set here was not generally, if, indeed, at all, followed.

It is doubtful where the kind of vault used at Le Puy was first devised. The central dome of St. Michael de l'Aiguille is, perhaps, the oldest of all, and this is, in fact, a square dome, if one may use the expression. The octagonal dome-vaults of the cathedral are probably a little later, but that over the crossing of the Church of Ainay at Lyons, may possibly be older; if you compare my sketch of it with that of the interior of Le Puy Cathedral, you will find that one is evidently copied from the other; and if the Le Puy vault was derived from Lyons, we make the important inference that it was an Eastern influence travelling up the Rhone, and distinct from that which we see at Perigueux, to which we owe this kind of domed roof; you will see some further evidence of this if you look at my sketch of the pendentives of the dome at Brioude,* which are identical in intention with the plan of the church of S.S. Sergius and Bacchus, at Constantinople, and yet quite unlike the kind of pendentive common in churches of the St. Front type. They are, in fact, the Le Puy and Ainay pendentives reduced to the very simplest conditions. The invention of the flying buttress adumbrated in, and possibly suggested by, the quadrant vaults of Auvergne, finally stopped these various endeavours after new forms of roofs, and set men to work to see how it might most readily be made to serve the boldest and most airy systems of design and construction; and in the rage for these, that old system of roofing with domes, which had been, so far as we know,† first tried in France at Perigueux, and had afterwards spread with such rapidity over a very large district—though with many modifications and variations—was entirely ignored or forgotten. Is it well that we too should ignore it? It is clear that the disciples of the Gothic school may claim it as their own with just as much truth as any other school can. And in some form or other it is often so attractive—so majestic on a large scale, so impressive even on a small scale—that few of us who have much work to do should altogether eschew all use of it, or treat it as though it were the exclusive property of the architects of Classic and Renaissance buildings. I do not feel, however, as most who write on the subject seem to do, that our domes must invariably be supported on what are called true pendentives. I think they are not beautiful, and I do not see that they are especially scientific. The St. Front pendentives are mere corbellings out of the wall, and in truth only imitations of pendentives. At St. Mark's they are formed with a succession of arches of brickwork across the angle of the dome, though this construction is not visible, and these, I suppose, are all wrong; but they are very similar in their intention to the kind of pendentive which I have had to illustrate to-night and which is in truth much more Gothic and picturesque in its character than the true pendentive, admits of any amount of decorative sculpture, and is really precisely similar in its object to the squinches under our own English spires.‡

I will add but a few words as to the constructional polychrome which distinguishes the exterior of the churches throughout this volcanic district. So far as I have seen it was never, save in Le Puy

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* I ought to mention that this dome and the western part of St. Julien at Brioude, is much older than the choir, to which I have before referred in speaking of the date of the church.

† This qualification is necessary, for the curious evidence which M. Verneilh has given us of the existence of a Venetian colony in the tenth century at Limoges would be enough to make it probable, that though St. Front is the earliest complete example extant of a French domed church, others may have been built before it, and that some of those which M. Verneilh supposes to have been derived from St. Front may really have been derived more directly from the East.

‡ There is no end to the diversity of the countries in which they are found. In the Cathedral at Worms we have squinches formed by semi-domes. In St. Nicodéme at Athens they are identical with those of St. Etienne, Nevers, and the same form is repeated in the domical vault of the steeple at Auxerre Cathedral. At Nôtre Dame du Port the dome is circular, but the squinches below are octagonal in plan, and the circle (which is not, however, a true circle) is set upon the octagon.

Cathedral, admitted into the interior,* and this is much to be regretted, because it seems that the vaults of their naves, the domes of their crossing, and the semi-domes of their sanctuaries, would have afforded most admirable fields for this kind of decoration. As I have told you, the walls were once covered with painting, and as long as this existed a mosaic of black and white and dull red would have been valueless; but now that the iconoclast, the whitewasher, and the restorer,—all of them at least as active in France as they have ever been in England—have done their worst, the want of some decoration on the otherwise bald surface of the vaults is painfully felt everywhere. Externally the coloured materials are used in two ways; sometimes the whole of the wall is built of the dark volcanic products, and patterns are obtained by the occasional use of white stone or by alternate courses of this and the darkest scoriæ that can be found. Or else the walls generally are built of stone, and the patterns only formed with the dark material. Here, too, as is the case in all old examples of coloured constructions with which I have ever met, the colours follow the natural course of the construction. At Le Puy, for instance, the courses are alternately light and dark, producing bold horizontal bands of colour. The arch stones are continued generally in one line of colour all across an arch, even when it consists of several orders, and from the arch on into the wall. The bands of ornament are similarly arranged in horizontal stripes, generally placed where they will dignify and give value to some very prominent architectural member. They never occur below the line of the springing of an arcade, and are richest under cornices and between their corbels. And when we consider the date at which this inlaid work was executed, and compare it with what we know of our own art at the same period, or, indeed, with that of any other portion of the country which we now call France, we cannot too highly extol its delicacy and grace and its carefulness of design and execution. M. Viollet le Duc considers the architects of these churches to have been the ablest of their time; he says, too, which is very true, that they never attempted more than they knew that they could accomplish, and the consequence is that, to this day, many of these buildings stand uninjured and undecayed, and all might well have done so had they received commonly fair treatment at the hands of their guardians. I believe, too, that we may regard the whole of the work in Vélay and Auvergne as that of native artists. The detail of sculpture is, when compared with such work as is to be found in Provence, exceedingly rude. It is vigorous, indeed, but wanting in that extreme delicacy and refinement which marks the work of the early Provençal artists.

It is probable that I have not carried you with me in my theory about the development of the perfect French chevet from the chevets of Auvergne, for I know how easy it always is to ride one's own hobby. The statement of this theory was, however, incidental to my remarks to-night. Originally, I intended only to give as good a description of the cathedral and other buildings of Le Puy, as my two days' study of them would allow; and this, because I could not find any published plans or drawings of them, and I thought that the measured plans and sketches which I was able to give you would, therefore, have more value than would otherwise be the case. I found it impossible, however, to resist saying something of the churches of Auvergne, because they are so mixed one with the other, with those of Vélay, and it is difficult to enter fully into one without knowing something of the others also. And it is almost equally difficult to enter upon the examination of churches such as these, without starting some theories, about which there may be ample differences of opinion among us.

Were I to attempt to say anything about the buildings of a later date it would be impossible to do more than to give a catalogue, which would be as unintelligible as it would be tedious.

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* This statement must of course be made with caution, inasmuch as the invariable white washing of the interior makes it very difficult to say what was the exact nature of the decorations with which they were adorned.

I will only say, therefore, on this head, that Clermont Cathedral well deserves careful study, and is rich in very fine glass; that at Montferrand may be seen as large a collection of Medieval houses of all dates as in almost any small town that I know; that Riom possesses a fine Sainte Chapelle: and that in the Abbey of Chase-Dieu are still preserved a very rare and complete series of tapestries of the sixteenth century. Besides these, a large number of articles of church plate are to be found scattered up and down in the village churches, and all this goodly store of antiquities is set before you in a province whose physical features are so full of interest and beauty as in themselves to make a journey through Vélay and Auvergne one which none will repent having undertaken.

Mr. Penrose, H.S.F.C., said he had had the advantage of passing through the district referred to by Mr. Street, a long time ago, and could confirm his remarks as to the exceedingly interesting nature of much of the architecture of Auvergne. The only place, however, at which he made any stay was at Clermont, and he was there much struck with the beauty of the cathedral. Though he had not been led into the interesting architectural research which Mr. Street had so ably carried out, he was able to record his impression of the remarkable character of the architecture of the chevet of that cathedral, which in colour, force and lightness, and the beauty of the radiating chapels. he had not seen paralleled anywhere else.

Mr. Street, Fellow, said the chevet of Narbonne Cathedral was identical in plan with that of Clermont.

Mr. Ferrey, Fellow, referred to the drawings in illustration of the variations and peculiarities of plan in the chevets of the churches of Auvergne.

Mr. Street, said there were generally either three or five chapels, but St. Front at Perigueux had four. The central chapel at Issoire was square in plan.

Mr. Morris, Associate, said that great credit was due to Mr. Street for his perseverance and skill. The country consisted chiefly of lava, which afforded, in a great measure, the material of which the buildings of the present time were constructed. While the country was thus naturally sterile, its historical had kept pace with its natural features; the population having been rude and lawless in the extreme. The only exception to the general barrenness was the excessive fertility of the vineyards. The architectural examples brought forward by Mr. Street showed a perfect consistency with the condition of things referred to. The architecture was clearly the production of Norman heads, and bore a very strict analogy to all the works of the Normans, whether in Sicily, Italy, or France. The evidences of architecture in Auvergne were certainly bold and picturesque, but nothing more. The many districts of England afforded abundant scope for the artist's talent, and he hoped the younger members of the profession would not be led away from such a field by the attractions of such a district as Auvergne.

The Chairman, Mr. G. Godwin, V.P., did not agree with Mr. Morris, but on the contrary hoped most sincerely that young architects *would* be led away to visit and study that portion of France which contained the interesting series of churches illustrated by Mr. Street (who had paid more attention to them than any other individual), because they were all of the greatest interest. especially when considered in connection with the churches of Poictiers, Angoulême, and other districts a little to the north of the Puy de Dome; all of which presented interesting problems for discussion and decision, which young architects might study with great advantage. Mr. Parker had contributed some papers to the *Archæologia*, showing some interesting analogies between the churches of the neighbouring country; and the best thanks of the meeting were due to Mr. Street for the extraordinary industry and ability with which he had accomplished

so much in so very short a time. The fact mentioned by Mr. Street that at one time there were as many as thirty silversmiths in the small district of Auvergne was interesting, and reminded him of the difficulty he had lately experienced in getting a small reliquary finished in London (even though it required a very small approach to art), without going to a very preposterous expense. It would be well if some mode could be devised by which that art might be more cultivated. He believed he had been the first to call attention to the subject of mason's marks. Mr. Street had only found them, he believed, on the soffites of the arches and not on the pillars. [Mr. STREET.—On the stones used for the superior work—the voussoirs of the arches.] He had himself met with them on the ashlaring and on the pillars, and in the rougher work they were on the bed of the stone, and not on the outside. It struck him that an observation of these marks would indicate the work of different periods.

The thanks of the meeting were unanimously voted to Mr. Street, and the meeting adjourned.

SECTION OF FURNACE CHIMNEY

at the

EAGLE FOUNDRY, BIRMINGHAM,

with Index to shew the elongation of the same when heated ___

SECTION OF FURNACE CHIMNEY

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EAGLE FOUNDRY, BIRMINGHAM,

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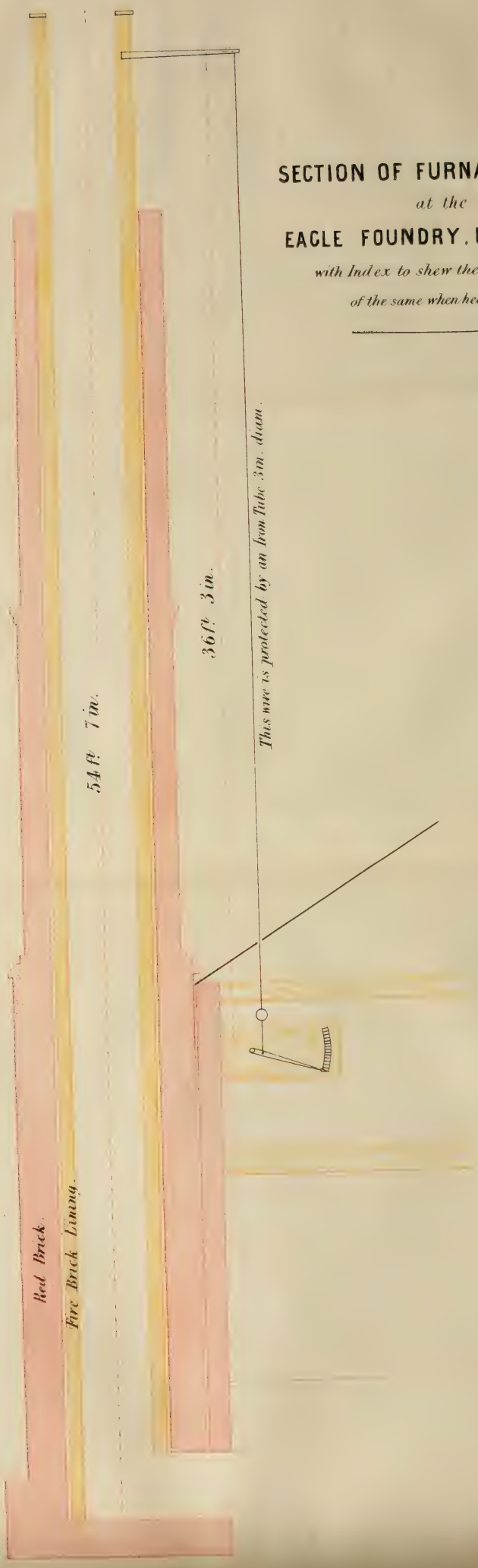
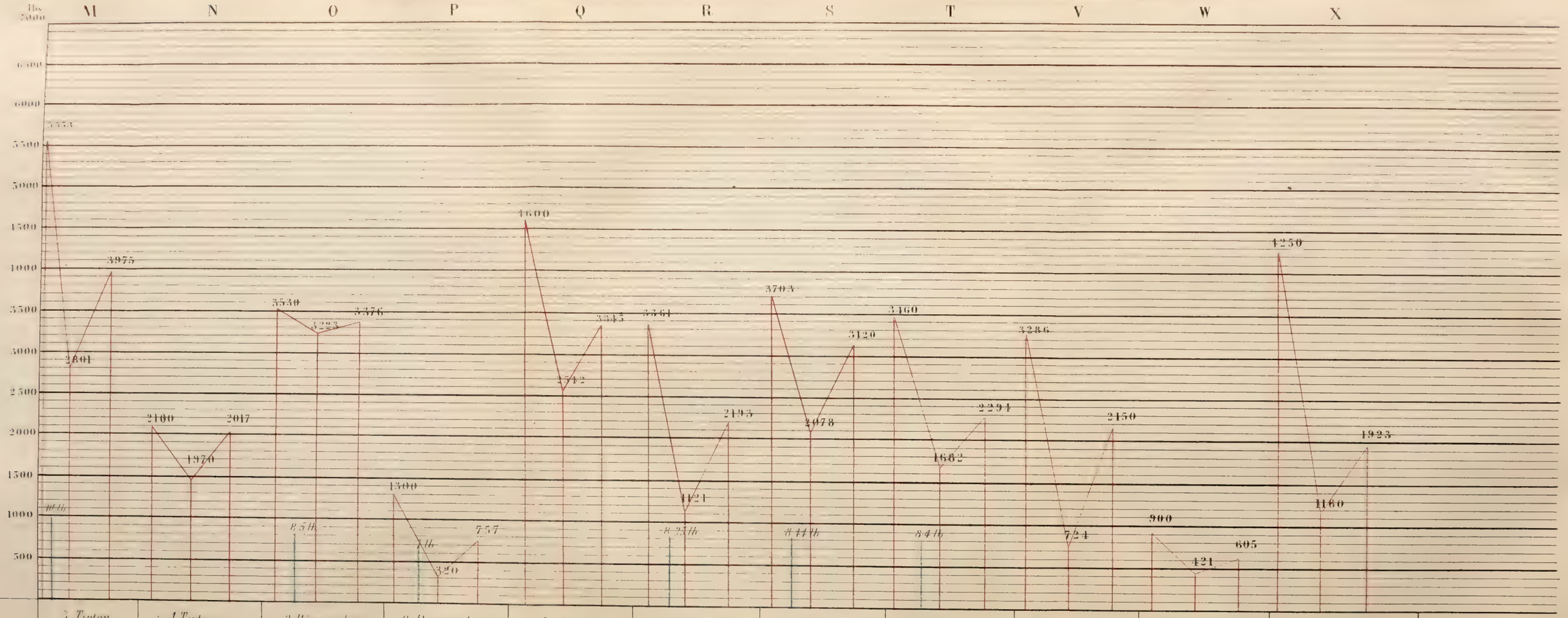


DIAGRAM ILLUSTRATING Mr HAWKES'S PAPER ON THE TRANSVERSE STRENGTH OF BRICKS FROM THE NEIGHBOURHOOD OF BIRMINGHAM.

The red lines indicate the breaking weight in pounds, bearings 7in apart — *The blue lines shew the relative weights of the bricks*

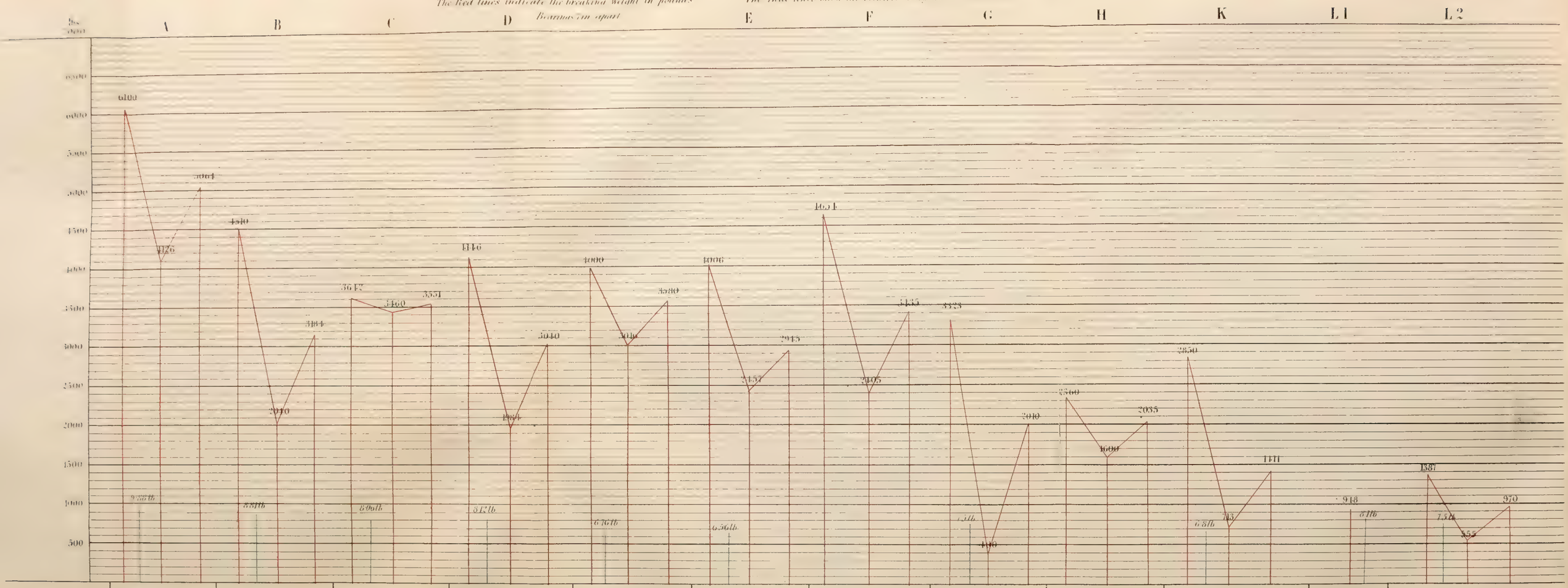


	M 3 Tipton Blue	N 4 Tipton made 1849	O 2 Birmingham Garrison & Stoney lane best	P 9 Birmingham Common	Q 5 Oldbury Barnsley Best	R 11 Oldbury Common	S 9 Oldbury Ingram Machine	T 5 Birmingham 80 Years old	V 37 Birmingham Vaughtons Hole Machine 1849	W 22 Birmingham Vaughtons Hole Hand made 1849	X 5 Birmingham 100 Years old.
Mean Size	8·68 4·2 × 3·2in	9 4·2 3·2 in.	9·12 4·23 3·18 in	9·08 4·29 3·07in	9·1 × 4·37 × 3·25in	9·1 × 4·4 × 3·16 in	9·27 × 4·43 × 3·19in	8·9 × 4·4 × 2·5in	9 × 4·37 × 3·25in	9 × 4·37 × 3·25 in.	8·87 × 4·33 × 2·25in
Absorbing power 22 hours immersion	0·3 per cent										
Weight at 9 4·2 3 oz per Blue lines on diagrams.	10 lb		8·5 lb	7 lb		8·25 lb.	8·44 lb	8·4 lb			

DIAGRAM ILLUSTRATING Mr HAWKES'S PAPER ON THE TRANSVERSE STRENGTH OF CERTAIN FOREIGN BRICKS.

The Red lines indicate the breaking weight in pounds — *The Blue lines show the relative weights of the Bricks.*

Bearings 7in apart



	1 Boston U.S. Best	2 Boston U.S. Common	3 Baltimore U.S. Best	6 Baltimore U.S. Common.	5 Dutch.	4 Dutch Clinker	9 Wraxeter near Shrewsbury.	11 Paris	7 Paris. Hollow	10 Calcutta.	18 Petersburg	4 Algoa Bay South Africa
							Pieces of the Hypocaust Tiles.					
Mean Size	7·5 × 3·5 × 2·46in	7·5 × 3·44 × 2·42in	8·54 × 4·23 × 2·31in	8·07 × 3·98 × 2·07in	9·26 × 4·35 × 2·46in	6·25 × 3·1 × 1·46in	8in. square 1·8thick	8·3 × 4·2 × 2·1in	10·4 × 4·3 × 4·25in 10·4 × 4·15 × 2·1in	10·13 × 5·09 × 2·3in	10·× 4·8 × 2·8in	9·12 × 4·18 × 2·37in.
Absorbing power 72hours immersion	3·6 per cent	5·9 per cent.	10·4 per cent	11·3 per cent.			Roman.			17·5 per cent.		
Weight at 9·4½ = 3 as per Blue lines on diagrams	9·38 lb.	8·81 lb.	8·06lb.	8·42 lb.	6·76 lb	6·56 lb.		7·51b.		6·8 lb.	8·11b.	7·5 lb.

ATING Mr. HAWKES'S

The red lines indicate the brea

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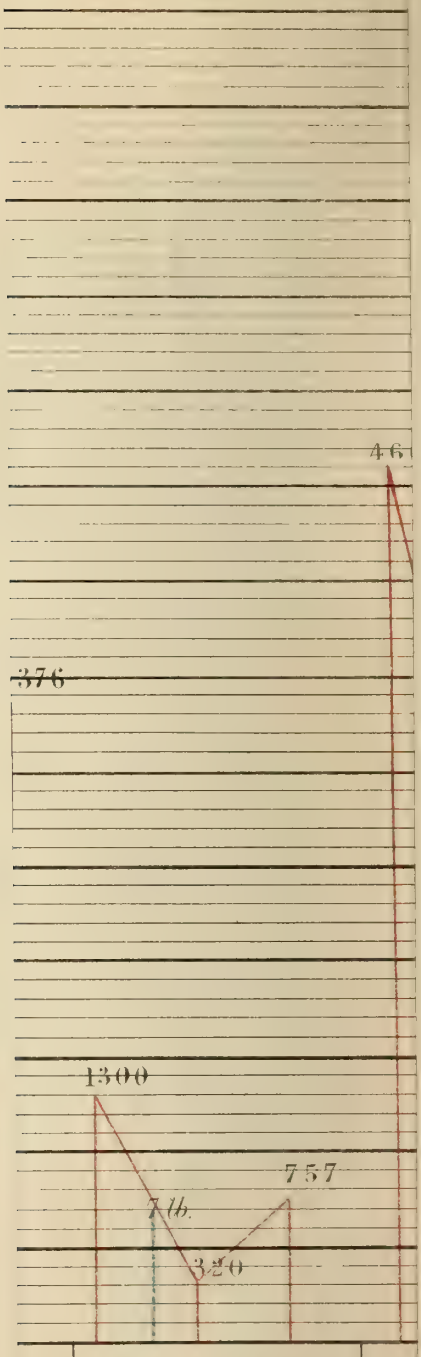

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in	9·08 4·29 3·07 in.	9·
	7 lb.	

ON THE TRANSVERSE STRENGTH OF BRICKS, AND ON EXPANSION OF BRICKWORK IN A FURNACE CHIMNEY.

By W. Hawkes, Contributing Visitor.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, January 21, 1861.

My attention was first called to this subject about ten years since, when I was having some farm buildings erected, and as these were several miles from either my residence or the office of the architect, I thought it would exercise a healthy influence over the builder if we could agree upon some standard of quality, or means of testing at any time what the bricks really were. Having experienced a like benefit in testing for the last thirty years the strength of pig-iron purchased for my foundry, I desired that thirty bricks should be sent to me as an average sample of the kind he purposed using. I found that the average strength of these bricks was, as far as I recollect, about 1300 lbs. When the bulk of the bricks was delivered, from the appearance not being favourable, we passed a number through the machine, and found the average strength was but about 800 lbs. This same plan I pursue with any bricks I may now have to purchase, and although the transverse strength may not indicate all that it is desirable to know of the qualities of a brick, yet, if it comes up to a good average strength, the brick is either made of good materials, or if of bad materials, the burning has been very good. Of course it is not expected that every brick will be tested, but as a couple of men with the testing machine I use can prove at least 300 per hour, that number would suffice to determine the quality of a vast quantity. Of course I do not mean that it can be ascertained what is the breaking point of the bricks, but what is the bearing power up to a certain agreed standard of strength. If, for instance, you wanted to test bricks at Boston, where the mean strength is 5,064 lbs., it might be considered that 4,000 lbs. was a fair test. If bricks had been purchased at a tested strength in the year 260, at Uriconium, about 3000 lbs.; or if in London in 1860, I would advise the brickmaker to limit his guarantee to 360 lbs., because unfortunately some have broken at 366 lbs.

The method I have adopted of testing bricks as we do our girders and beams has not, I think, been usually adopted by others, the usual test being that of resistance to a crushing force. The strength of a cast-iron structure is calculated from knowing that a bar of iron 3 feet long and 1 inch square will require about 750 lbs. to break it, and its sustaining power may be taken at about two-fifths of the same. If it be known what is the transverse strength of bricks, and if the mortar, after it is thoroughly set, may be taken of a like strength with the bricks (and in those experiments of Mr. Barlow on the transverse strength of brick pillars, tested horizontally, the fracture was not through the joints, but the solid bricks) a calculation may be made as to the sustaining power of brick beams or lintels, whether built as beams similar to the one tested in 1851 at the Great Exhibition, or whether portions of walls from which wood lintels, door or window frames have been removed. The resistance to a crushing force as tested by the hydraulic press, in which it is said that bricks will resist from 30 to 100 tons, tells you that which you hardly ever want to know, for it would require a wall upwards of 2,000 feet high before you got a pressure of 30 tons on the surface of a brick; but it might be useful to know, that if in a 9-inch wall you have 40 inches in depth over an opening 90 inches wide, you might distribute a weight of 13 tons over the same, if the bricks be of moderate strength, and the mortar as strong as the bricks. I think that a comparison of the transverse strength of bricks may be made with much more certainty than their power to resist a crushing force. That proving machine is best which subjects all that it tests

to similar conditions, to similar punishment. If it chanced that the upper and lower surface of bricks were as true as the two planed surfaces of the hydraulic press crushing plates, then a fair comparison would be made: but when, perhaps, bricks have a concave lower face and a concave upper one, the first effect of the hydraulic machine is to break the brick transversely into several pieces before the crushing begins. Again it is a more tedious operation, and requires rather a costly machine, and it would be almost impossible to fix upon any test strength by which bricks should be proved up to a limit, say two-thirds of that which would crush them; for if the good bricks were not quite true they would most assuredly break, while a very inferior quality as to strength, but having two flat surfaces, would sustain the pressure. The pressure and weights given were, in each case, in the centre of the brick.

DESCRIPTION OF DIAGRAM.

The diagram before you is intended to represent, at one view, the strength of bricks from different districts. The strong horizontal lines drawn one inch apart denote a strength of 500 lbs., and the fainter lines one-tenth of an inch apart, a strength of 100 lbs. The vertical red lines denote the strength of the bricks, which is easily read off by noting their intersection with the horizontal lines, and carrying the eye to the margin where the figures give the exact strength. The shorter vertical lines (blue) at the bottom of the diagram represent, according to their different heights, the difference in the weight of the bricks. The absorbing power is given in figures. It will be observed in comparing the strength of the thin bricks and tiles (say all those whose thickness does not exceed $2\frac{1}{4}$ inches) with the strength of the thicker bricks, that the former much exceeds the latter; for instance, in the 35 kinds of bricks the average of the strongest is 2,855 lbs., the average of the mean strength, 2,125 lbs., and that of the least strength is 1,557 lbs., the thickness varying from 3·25 in. to 1·7 in.; while from the 9 thinner description of bricks, none of them exceeding 2·25 in. in thickness, we obtain 4,088 lbs., 2954 lbs., and 2,070 lbs. as the greatest, mean, and least strengths, giving an excess of strength over the average of the whole of 1,233 lbs., 829 lbs., and 513 lbs.

Strength of Bricks under continuous pressure.—The strength of bricks given in the diagram is the weight sustained before the last 10 lbs. is added, such weight being added at intervals of half a minute or less, but it does not give what it is very important to know, for how long a brick would carry a weight without breaking. One of the common Boston bricks, which broke with a weight of 920 lbs., sustained a weight of 690 lbs. for 48 hours, and then broke with a weight of 1,330 lbs. Of course these experiments were made upon the half brick, and calculated out at the standard size and bearing. One of the bricks made from dried ground clay by pressure, sustained a weight of 820 lbs. for 48 hours (its original strength being 898 lbs.); weights were then added up to 950 lbs., when it broke. I have found in several instances that the half brick requires a greater weight to break it than when whole; of course the difference in the lengths of the bearing is taken into account, indeed all the strengths are calculated throughout at a bearing of 7 inches. The Baltimore brick, which broke with 850 lbs., carried 735 lbs., for 10 hours, and then broke. In comparing weight with strength I find that the average weight of 25 bricks from different districts is 7·85 lbs., and the strength usually increases with the weight. The Tipton blue, which weighs 10 lbs., gives a strength of 5,555 lbs., 3,975 lbs., 2,801 lbs. The Boston weighs 9·88 lbs., giving 6,100 lbs., 5,064 lbs., 4,126 lbs.; and the Leeds weighs 9·07 lbs., giving 4,133 lbs., 3,198 lbs., 2,616 lbs.; while the lightest London brick, weighing 6·19 lbs., gives 1,496 lbs., 998 lbs., and 366 lbs., not allowing for the frog. The Calcutta brick, weighing 6·8 lbs., gives 2,850 lbs., 1,411 lbs., and 713 lbs. The Dutch clinker is an exception, the weight being only 6·56 lbs., and the strength respectively 4,006 lbs., 3345 lbs., and 2542 lbs.

EXPERIMENTS.

Best Boston Bricks.—There were four of these tested of an average size of 7·5 in., by 3·5 in., by 2·16 in. The bricks carried as follows:—2,780 lbs., 2,440 lbs., 2,270 lbs., and 1,880 lbs., which calculated upon one common size of 7 in. bearing, by 4½ in., by 3 in., gives the mean strength of 5,064 lbs., the greatest being 6,100 lbs., and the least 4,126 lbs. The weight of the bricks, calculated upon a size of 9 in., by 4½ in., by 3 in., was 9·88 lbs., and the absorbing power, after twenty-four hours' immersion, was 3·6 per cent. upon the weight when dry. These bricks have a fine smooth surface, very straight and square at the edges; the fracture clear and equal, free from all kinds of rubbish or pebbles. The cost of these at Boston is 17 dollars per thousand; the colour red. The cost of labour is about 5 dollars per thousand. My informant states that some years since a company was established for making the bricks by crushing the dry clay, then sifting or bolting it, and then forming the bricks in moulds, and subjecting them to great pressure. This experiment failed, after an expenditure of 170,000 dollars.

Common Bricks, Boston make.—Four of these bricks carried as follows:—2,220 lbs., 1,600 lbs., 1,230 lbs., and 920 lbs., the average size being about the same as the best, or say 7·5 in., by 3·44 in., by 2·12 in. The strength calculated upon the common size of 7 in. bearing, by 4½ in., by 3 in., gives a mean strength of 3,184 lbs., the greatest being 4,510 lbs. and the least 2,040 lbs.; the weight of the bricks at 9 in., by 4½ in., by 3 in., was 8·81 lbs., and the absorbing power 5·9 per cent. Not having been pressed they are not so smooth and fine in the finish, but yet they are very sound and free from rubbish in the fracture; the colour is dark red. The labour of making these is about 2 dollars per thousand.

Baltimore Best Bricks.—Two of these were tested, of an average size of 8·54 in., by 4·23 in., by 2·31 in. These bricks carried the following weights:—1,980 lbs. and 2,010 lbs., which calculated upon the common size, 7 in., by 4½ in., by 3 in., gives 3,642 lbs. for the greatest, 3,460 lbs. for the least, and 3,551 lbs. for the mean strength. The weight of a brick of the standard size, 9 in., by 4½ in., by 3 in., is 8·06 lbs., and the absorbing power 10·4 per cent. These bricks have a fine smooth surface, nearly equal to the Boston brick; the fracture clear and free from rubbish of any kind. These specimens were taken from the run of the kiln, and may be considered of an average quality of an entire kiln (from what is called "Arch to Salmon"), of 200,000. They are hand-made, and burnt in an ordinary kiln, the top being boarded over during the first part of the burning. They are first made by hand, and then pressed in an iron mould, which is well oiled, the pressure being given by steam power. These bricks are so set in the kiln as to save one edge and two ends, that they may be quite even and true. The cost of making these front bricks, including pressing, is 5 dollars per thousand. The very best picked bricks of this kind are selling at 25 dollars per thousand, the ordinary bricks at 6 to 8 dollars per thousand. The very high price of the best "Latch bricks" is owing to the numbers which are rejected as "best quality" by having the edges ever so slightly injured. Bricks are also made by machinery, but are not so much esteemed by the builders; they are inferior to the hand-made, and sell from 1 to 2 dollars less per thousand.

Baltimore Common Bricks.—Six of these were tested, of an average size of 8·07 in., by 3·98 in., by 2·07 in. They carried the following weights, viz., 1,680 lbs. (the weight remaining upon this brick for nearly an hour before it broke), 1,540 lbs., 1,420 lbs., 1,250 lbs., 970 lbs., and 850 lbs. The weight at 9 in., by 4½ in., by 3 in., is 8·12 in., and the absorbing power 11·3 per cent. The strength of these bricks, at the standard size, gives a mean of 3,040 lbs., the greatest being 4,146 lbs., and the least 1,984 lbs. The price of the common bricks is 6 to 8 dollars per thousand, and the best "Latch" 15 dollars per thousand. The bricks which carried 850 lbs. (equal to 1,984 lbs. on the standard size), carried 1,470 lbs. for ten hours. The above bricks, with particulars of price, &c., were sent to me by N. F. Williams, jun.,

of Baltimore, in September 1859. The fuel used is the small Anthracite "dust," but in some quarters the bituminous coal is used. Some are burnt with wood, taking as an average half a cord per thousand. The ordinary price of Anthracite coal is 25*s.* per ton. Experiments have been made by the Government upon the strength of brick, but not published. These bricks have been tested, in order to compare the strength of them with stone, and they proved stronger and more durable, particularly where age is taken into consideration, the bricks from old buildings being very sound, while stone from buildings of similar age was soft and crumbled.

The Dutch Bricks were purchased of Messrs. Rosher and Co., Lime Wharf, Holland Street, London; three of them were of an average size of 9·26 in., by 4·35 in., by 2·16 in., and carried, at a bearing of 7 in., 2,110 lbs., 1,910 lbs., and 1,410 lbs., giving, when calculated at the standard size, 4,000 lbs. as the greatest strength, 3,580 lbs. as the mean, and 3,016 lbs. as the least. The weight of these, at the standard size, is 6·76 lbs. The size of the four smaller clinker bricks is 6·25 in., by 3 in., by 1·46 in., and give a strength, as compared with the others, of 4,006 lbs. greatest, 2,945 lbs. mean, and 2,457 lbs. least. The weight of these is rather less than the larger size, being 6·56 lbs. only. In comparing the strength and weight of the Dutch clinkers even with the strong American common bricks, the result is in favour of the former, the mean strength of the American brick being 3,112 lbs., and the weight 8·46 lbs., while the clinkers give a strength of 3,262 lbs., and only 6·66 lbs. in weight. These clinkers are made at Moor, near Gouda, in South Holland, from the slime deposited on the banks of the River Yssel, and formerly from that of Haarlem Meer. The colour is a light yellowish brown. "The clay or slime is washed to get rid of the earthy matter before being moulded. When in Holland some years since I built a small brass furnace, and lined the chimney 40 ft. high with fire brick, but we ran down (*i.e.* melted) the clinker brick above this, the first day's trial." This information was sent me by the late Mr. Nicholas Harvey, the eminent Cornish engineer.

Nine pieces of Roman tile from Wroxeter ("Uriconium"), near Shrewsbury. They were fragments of the 8 in. Hypocaust tiles, about 8 in., by 3·5 in., by 1·8 in., and gave 4,670 lbs. for the greatest, 3,567 lbs. for the mean, and 2,630 lbs. for the least strength. The tile, 4 in., by 2·6 in., by 1 in., used in the herring-bone pavements, carried 3,742 lbs., calculated at the standard size. The colour of these tiles is light red, and they are very sound in the fracture; nearly all of them had the circular score marks so common on Roman tiles. Some of them had the appearance of having been made of two "sheets" of clay folded one over the other, as if the clay had been prepared in laminæ of about $\frac{3}{4}$ or $\frac{7}{8}$ of an inch thick, the coating of sand sticking to the separate laminæ being sometimes perceptible in the fracture. Mr. Roach Smith is of opinion that the Roman tiles were burned with wood, but neither he nor Dr. Collingwood Bruce have ever met with a Roman brick-kiln. Mr. Smith writes me, "that in all the modern and mediæval examples I have been able to examine sand predominates, the Romans worked pure clay (or such that was best adopted for the purpose). This would partly explain the superior character and greater durability of ancient bricks." They were made to last for ever, the modern are made to sell. I might notice that the tiles in the Hypocausts at Wroxeter are set in clay, as recommended by Vitruvius, clay being less acted upon by fire than mortar. The two herring-bone tiles from Bath, 5·4 in., by 2·7 in., by 2·9 in. about, give, at standard size, 6,460 lbs. and 5,840 lbs. Eleven bricks made in the neighbourhood of Paris, of an average size of 8·8 in., by 4·2 in., by 2·1 in., which carried the following weights;—1,740 lbs., price £2 5s.; 1,540 lbs., £2 18s. 4d.; 1,262 lbs., £2 16s. 8d.; 1,252 lbs., £2 18s. 4d.; 1,102, 1,530, £3 15s.; 1,040 lbs., £2 12s. 6d.; 980 lbs., £2 5s.; 620 lbs., £2 16s. 6d.; 620 lbs., £2 12s. 6d.; 400 lbs., £1 17s. 6d.; 200 lbs., £1 17s. 6d. The strength of these at the standard size was, greatest 3,323 lbs.; mean 2,010 lbs.; least 370 lbs. The weight at

standard size, 7·5 lbs. The highest priced brick £3 15s., which carried 2,180 lbs. at the standard size, is a good smooth brick, dark red colour, and made for Vincennes Railway Viaduct (Hand-made, Stamp C.) The strongest brick was 3,323 lbs., and the price £2 5s. per thousand. It is called "Brique de Pays," and made in the neighbourhood of Paris. The weakest brick, 400 lbs., was soft and rotten, of a dark buff colour, and seemed to be made of a kind of mud and sand, containing very little clay, and having, as the test proves, very little cohesion.

The four hollow bricks, machine-made, Paul Borie and Co., and which were in cross section, as follows:—Price 100 francs (£4 3s. 4d.), one 4·25 in. by 4·3 in., having nine apertures about 1 in. square, one 2·45 in. by 4·2 in., having two apertures about 1·6 in. square; price 60 francs (£2 10s.), one 2·6in. by 4·15 in., having six apertures, 1 in. by ·70; and price 60 francs (£2 10s.), one 2·6 in. by 4·20 in., having six apertures, 1 in. by ·8. These bricks carried, at the standard size of 3 in. by $4\frac{1}{2}$ in., 2,360 lbs., 2,233 lbs., 1,950 lbs., and 1,600 lbs. In the "Building News" of March, 1858, and April, 1858, folio 317 and 382, reference is made to the first introduction of hollow bricks in 1812, and also upon the disputed claims of Mr. Beart and Borie, Brothers, of Paris.

Ten bricks from Calcutta, having a mean size of 10·13 in., by 5 in., by 2·3 in. The greatest strength, at the standard size, was 2,850 lbs.; the mean, 1,411 lbs.; the least, 713 lbs. These bricks are light, being 6·8 lbs., and the absorbing power great, being 17·5 per cent. The strength of the bricks was 2,110 lbs., 1,560 lbs., 1,160 lbs., 1,100 lbs. These were made by Messrs. Mackintosh, Burn and Co., Builders, Calcutta, one of the first houses in the trade. The other bricks were weaker, being 1,050 lbs., 1,000 lbs., 940 lbs., 570 lbs., and 480 lbs. These bricks were of about the same size.

Mr. Joseph Walmsley, of the firm of Messrs. Mackintosh, Burn and Co., to whom I was introduced by Messrs. Osler, writes me with the sample bricks;—

"Calcutta, September 8th, 1859.

"The fuel used for burning bricks in India is wood and coal, and they are burnt in clamps, not kilns. To burn 100,000 bricks, if of a thickness of 3 inches, it requires 200 maunds, or 146 cwt. of wood and from 600 to 700 maunds, or about 512 cwt. of coal. Less fuel is required if the bricks be thinner."

This gives but about 7 cwt. to the thousand.

Labour.—Three coolies will make 1,000 per day; *i. e.*, one boy to carry the clay, another to puddle, and one man to mould. The bricks are moulded on the ground (this accounts for the unevenness of the surface), and as one brick is made the moulder passes on and makes another, side by side, and so on. This is the old style. Moulding tables and machinery have been introduced, but as yet with little success, for it requires such close superintendence to make a native do anything different to what he has been in the habit of doing. The bricks usually remain on the ground from a fortnight to three weeks previously to being put in the clamp, where they are burning from three to six weeks. The temperature in the hot weather on the drying ground is 160° Fahrenheit. The cost of the common bricks in Calcutta is about 12s. per thousand, but the better kind, marked M. B. & Co., are worth 16s. to 18s. per thousand. All the bricks have a very rough and common appearance; there is nothing like finish either on the sides or angles. Being made on the ground they partake of all the irregularities of a badly prepared bed. In order that the clay may relieve itself from the mould without much trouble it is made taper nearly $\frac{3}{16}$ths of an inch, which of course makes the bricks of a like taper. The fracture of the bricks was sound and free from rubbish.

Russian Brick.—I have only one specimen of a Russian brick, one sent from St. Petersburgh, but as it was sent as a pattern for a machine to make similar sizes, we may infer it was a fair sample. The

size is 10 in., by 4·8 in., by 2·8 in., and the strength 880 lbs., which, calculated at the standard size, is 948 lbs., and the weight at the dimensions 9 in., by 4½ in., by 3 in., is 8·1 lbs.

Four bricks from Algoa Bay, South Africa, sent by Mr. E. Brooke Smith. These are very well-made bricks, of a straw or whitish-brown colour; the average size is 9·12 in., by 4·18 in., by 2·37 in.; there is a groove on one side of the brick about 6 in. long by 1 in. wide. Their strength, calculated out at the standard size, is 1,387 lbs. for the greatest, 970 for the mean, and 555 lbs. the least. The weight at our standard size is 7½ lbs. each. The fractures were free from rubbish, and from the sound appearance of the bricks I should have supposed that they would have carried more than they did.

Extracts from a letter received from Mr. E. B. Smith, Algoa Bay, South Africa, dated April 15th, 1859:—

"The clay is found in large beds about a mile from the town, and half a mile from the sea-shore, where it is quarried and carted to the kiln; it is then mixed with beach sand, and then the two are thoroughly ground together by a mill, worked by a horse; but before it is mixed with the sand, I should have told you, it is spread out to dry, then watered, allowed to dry again, and after that it is ready for the sand. When it leaves the mill (which is a rude piece of machinery consisting of a wooden cylinder into which the lumps of clay are put, and a clod-breaker revolving in it) it is at once moulded in the same way as in England. The bricks are stacked up in long sheds open at the ends, where they are left to dry; this sometimes takes two or three weeks.

"The kiln is somewhat the shape of the accompanying sketch; the bricks are stacked above the line A B to within a short distance of the top, spaces being left between them for the circulation of the heat into every part. When the kiln is full all the openings are bricked up and fires kindled in the holes C D, which extend right across and are open at the top to allow the flame to come in contact with the bricks. The only outlet for the smoke is through the hole at the top.

"The kiln which I saw was about 40 ft. high from top to bottom, and 20 ft. across the widest part inside; it would burn about 25,000 at once; the fuel used is wood.

"As far as I could learn the cost of making is as follows:—

	Per thousand. s.	d.
"Clay, sand, and all the material, labour, tools, horse, &c., including everything but fuel, rent, fixtures, and risk of breakage and waste -	17	0
"Fuel - - - - - - - - -	10	0
"Total - - - - - -	27	0

"The selling price at the kiln is from 38s. to 40s. per thousand. The labourers are mostly whites, though coolies are now and then employed for the heavy and dirty part of the work. You will no doubt notice the whiteness of the bricks, which is owing to the sand mixed with the clay. The bricks take from 30 to 60 hours to burn, and are then left for about a week to cool before they are removed."

Three Tipton blue bricks made in 1859, of an average size of 8·68 in., by 4·2 in., by 3·2 in., at the standard size, carried 5,553 lbs. greatest, 3,975 mean, and 2,801 least. This is the heaviest brick I have met with; it weighs 10 lbs. at the dimensions 9 in., by 4½ in., by 3 in. Its absorbing power is the least, being hardly perceptible, two bricks giving but about 0·3 per cent. The second quality absorbed but very little more, two bricks weighing, when dry, 17·3 lbs., and after immersion for twenty-four hours only 17·5 lbs.

Four Tipton blue bricks made in 1849, mean size about 9 in., by 4·2 in., by 3·2 in.; these were not

nearly so strong as those now made, the greatest being 2,100 lbs., mean 2,017 lbs., and the least 1,970 lbs.

Two best Garrison Lane, Birmingham, hand-make, clay passed through only one pair of rollers.—The greatest strength, 3,530 lbs.; the least, 3,225 lbs.; giving a mean of 3,376 lbs.; the weight, 8·5 lbs.; the average size, 9·12 in., by 4·23 in., by 3·18 in.

Nine common bricks from the same neighbourhood, say Stony Lane and Ladypool Lane, gave the greatest strength at 1,300 lbs.; mean, 757 lbs., least, 320 lbs. The weight, 7·06 lbs.; and the average size, 9·08 in., by 4·29 in., by 3·07 in. The price of the best face, 35s., and the common, 21s. per thousand. In both the latter instances the clay is passed through one pair of rollers only.

Five best Oldbury bricks, made by Messrs. Barnsley and Sons.—The greatest strength, 4,600 lbs.; the mean, 3,345 lbs.; and the least, 2,542 lbs. The average size is 9·1 in., by 4·37 in., by 3·25 in.

Eleven common bricks, greatest strength, 3,361 lbs.; mean, 2,193 lbs.; least, 1,121 lbs.; weight, 8·25 lbs.; average size, 9·1 in., by 4·4 in., by 3·16 in. This clay is passed through two sets of rollers and a pugmill; the bricks are hand-made.

Ingram, Oldbury, adjoining yard.—These are machine-made. Nine bricks gave the following results: the greatest, 3,703 lbs.; the mean, 3,120 lbs.; and the least, 2,078 lbs.; the weight, 8·44 lbs.; and average size, 9·27 in., by 4·43 in., by 3·19 in. The clay is treated in a similar manner to that adopted by Messrs. Barnsley, with the addition of the machine for forcing the clay into the mould by machine power instead of by hand.

Five bricks, Birmingham, about eighty years old, greatest strength, 3,460 lbs.; mean, 2,294 lbs.; least, 1,682 lbs.; average size, 8·9 in., by 4·4 in., by 2·5 in; weight, 8·4 in.

Thirty-seven bricks made by Ingram's patent machine, at Vaughton's Hole, Birmingham, 1849, greatest strength, 3,286 lbs.; mean, 2,510 lbs.; least, 724 lbs.; the sizes of these bricks may be taken at 9 in., by 4·37 in., by 3·25 in.

Twenty-two hand-made bricks of the same dimensions, yard, and similar clay and baking.—The greatest strength of these was 900 lbs.; the mean, 605 lbs., and the least, 421 lbs.; the ordinary size, 9 in., by 4·37 in., by 3·25 in.

Six Birmingham bricks, about 100 years old, greatest strength, 4,250 lbs.; mean 1,923 lbs.; least, 1,160 lbs.; average size, 8·87 in., by 4·33 in., by 2·25 in.

Eighteen machine-made bricks from Leeds, greatest strength, 4,133 lbs.; mean, 3,198 lbs.; least, 2,616 lbs.; weight, 9·07 lbs.; average size, 9·1 in., by 4·25 in., by 3·21 in. These were made by Bradley and Craven's machine (of Wakefield). They were taken from different parts of the kiln, but there was not so much difference as might have been expected. The mean strength of the six bricks at the bottom of the kiln was 3,438 lbs.; in the middle, 3,133 lbs.; and at the top, 3,023 lbs. On May 14th Bradley and Craven wrote to me, saying that "the machine consists of a pair of rolls placed over a pugmill, the bricks being formed in moulds under the pugmill; the clay is taken direct from the pit, and undergoes no previous preparation, in some cases no water is added."

Hand-made ditto, greatest strength, 1,233 lbs.; mean, 1,038 lbs.; and the least, 835 lbs.; average size, 9 in., by 4·5 in., by 3·5 in.

Four bricks from Messrs. Browne and Co., Bridgwater.—The greatest strength, 3,200 lbs.; mean, 2,318 lbs.; least, 1,515 lbs.; weight of brick, 7·06; average size, 8·9 in., by 4·25 in., by 2.65 in. Two of the bricks were best, having a strength of 3,200 lbs., and 2,330 lbs. and the two common, 2,230 lbs., and 1,515 lbs., calculated at the standard size.

The strength of a tile 1·6 in. thick gave us the mean of seven experiments, 3,600 lbs., greatest;

3,107 mean; 2,045, least; calculated at the standard size. The fracture of both bricks and tiles sound and free from rubbish. All are hand-made and burnt in a close arched kiln, about 20 feet, by 19 feet, by 14 feet 6 in. high, fired for about seven days. The clay is rolled and pugged, and as it leaves the mill is cut off in suitable lengths and carried to the moulder. The bed of clay is close to the river, and comes within 9 feet of the surface, and is about 18 feet thick. (Fresh water deposit.) The weight of a brick of the size stated above (8·9 in., by 4·25 in., by 2·65) when wet from the mould is $8\frac{1}{4}$ lbs., when dried fit for the kiln, $6\frac{1}{4}$ lbs.; and when burnt, about $5\frac{3}{4}$ lbs.

Four bricks from near Weymouth (G. H. Crickmay, three miles from Weymouth), greatest strength, 2,680 lbs.; mean, 1,940 lbs.; least, 1,480 lbs.; weight, 7·33 lbs.; average size, 8·61 in., by 4·07 in., by 2·52 in. These bricks are hand-made; one pair of crushing rolls, but no pugmill.

Six bricks from two yards nearer Weymouth, greatest strength, 1,152 lbs.; mean, 725 lbs.; least, 590 lbs.; weight, 7·7 lbs.; average size, 9·4 in., by 4·5 in., by 2·55 in. The clay is passed through one pair of rolls. These bricks were not sent to me by the makers, the four first were ! !

Three bricks from Colchester, greatest strength, 1,810 lbs.; mean 1,389 lbs.; least, 1,050 lbs.; weight, 8·67 lbs.; average size, 9·1 in., by 4·15 in., by 2·2 in. These came from the yards of Alston and Daniel, at Mile End, near Colchester; the price is 24s. per thousand, they have a slight hollow; this was not allowed for in the testing. The colour at the fracture was a dark red, and one of them had a few small pebbles in it.

Nine white bricks, maker, Jarrow, near Leicester, greatest strength, 1,472 lbs.; mean, 1,104 lbs.; least, 824 lbs.; average size, 9 in., by 4·3 in., by 3·16 in. They are sunk on one side for $2\frac{1}{2}$ in. by 3·8 in. They carried 1,462 lbs., 1,392 lbs., 1,252 lbs., 1,132 lbs. 1,052 lbs., 1,002 lbs., 902 lbs., and 892 lbs., at ordinary size.

Nine perforated bricks (white) from Rugby (White and Green), machine-made.—The greatest strength, 1,222 lbs.; mean, 847 lbs.; least, 407 lbs. These bricks broke through the perforations, having three holes half an inch diameter. The reduction of the section by these holes is about one-third of the brick, and by adding on one third to the mean strength, say 847 lbs. plus 282 lbs., equal to 1,129 lbs., against 1,104 lbs. of the solid brick. The weights the bricks carried (not calculated out at the common standard) were 1,222 lbs., 1,022 lbs., 1,012 lbs., 862 lbs., 822 lbs., 552 lbs., 422 lbs., 362 lbs.

Four Oxford bricks gave greatest strength, 1,187 lbs.; mean, 1,087 lbs.; least, 875 lbs.; the weight, 7·9 lbs.; and the size, 9 in., by 4·24 in., by 2·64 in.

Seven London bricks (proved June 25, 1859), greatest strength, 1,496 lbs. (stock); mean, 998 lbs.; least, 366 lbs. (place); weight, 6·19 lbs.; average size, 9·2 in., by 4·5 in., by 2·7 in. The weights of the bricks carried at the ordinary size were, the first lot, 1,142 lbs., 1,042 lbs., 952 lbs., 662 lbs., 652 lbs., 422 lbs., all these being stock bricks, and the last, a place brick, 270 lbs.

Seven London bricks (proved October 14th, 1859), greatest strength, 1,396 lbs.; mean, 825 lbs.; least, 485 lbs. (place); weight, 6·58. The weight both of this and the former lot is calculated at the standard size. The weights carried were 970 lbs., 690 lbs., 580 lbs., 400 lbs. (stock bricks); and 650 lbs., 490 lbs., 340 lbs. (place bricks). The sunk cavity or frog is not allowed for, if it were it would give a little addition to the strength in both cases.

Ten tiles from Andrew Cuthell, Esq., late Messrs. Cubitt.—These tiles he uses as bond courses, and you will see a good specimen of them in some houses which he is now erecting in Gordon Square. They are called tile beams, their structure will be seen on referring to the diagram. The sizes of these tiles are about 14 inches long, by 5 inches wide, by $\frac{3}{4}$ of an inch thick. The average strength of ten which I have proved was 5,055 lbs., the greatest being 6,900 lbs., and the least 3,740 lbs. This shows

great increase of strength over the ordinary London bricks, the average strength of which was only 911 lbs. The weight of these tiles calculated out at the standard size is 7·35 lbs.

Four bricks from St. Alban's.—The greatest strength of these was 1,105 lbs.; the mean, 961 lbs.: and the least, 873 lbs. The weight at the standard size was 7·63 lbs., and the size, 9·14 in., by 4·29 in., by 2·6 in.

Four bricks, dry clay, made by Mr. Platt, of Oldham, greatest strength, 1,193 lbs.; mean, 982 lbs.: least, 898 lbs.; weight at 9·4½ by 3, equal to 8·31; absorbing power, 9·27 per cent.; size, 9·1 in., by 4·4 in., by 2·9 in. These bricks were exhibited at the meeting of Mechanical Engineers in Birmingham, in 1858, when a paper describing the machine was read. This machine was likewise described at one of your own meetings last year. The weights which the bricks severally carried at the ordinary size were 1,090 lbs., 842 lbs., 842 lbs., and 820 lbs., showing much uniformity in the strength. All these had a cavity or frog. As these specimens were brought as a sample of what could be done in dry clay we may infer that the best were selected.

Four bricks from Nottingham, at Carlton Hill, the brickyards of Mr. W. Burgess.—The greatest strength was 2,142 lbs.; least, 1,090 lbs.; mean, 1,583 lbs.; calculated at standard size, 7 in., by 4½ in., by 3 in. One tile, 8·75 in., by 8·75 in., by 2 in.; bore, 2,314 lbs., at standard size. One of the bricks was proved while wet, after 22 hours immersion, its strength was 1,811 lbs. Ordinary size of brick, 9½ in., by 4½ and $\frac{1}{16}$ in., by 3$\frac{1}{16}$ in., and 9$\frac{5}{16}$ in., by 4$\frac{5}{8}$ in., by 3 in. The clay is usually got in the autumn and exposed to the frost through the winter. The clay is rolled. The bricks are dried in a drying-house before putting in the kiln. One ton of slack dries 6,500 in 24 hours: the absorbing power was 1 lb. 15 oz., the weight when wet being 9 lbs. 4½ oz., and when dry 7 lbs. 15½ oz., the size of brick being 9$\frac{7}{16}$ in., by 4$\frac{5}{8}$ in., by 3 in.

Glass.—The four pieces of glass, common kind, which I proved were cut from one strip 5 inches wide and 4 inches thick the pieces were 6 inches long and 5 inches wide, and (calculated out at the standard size of the bricks) gave 17,208 lbs., 15,435 lbs., 14,931 lbs., and 11,385 lbs., the greatest being 17,208 lbs.; the least, 11,385 lbs.; and the mean, 14,931 lbs. This great difference is all the more singular from the circumstance of all the pieces being cut from the same plate. The weight at 9 in., by 4½ in., by 3 in., would be 11·12 lbs. The increase of strength in bricks is sometimes due to the partial vitrification of the outside, the great increase of strength from complete vitrification is seen in the experiments on glass.

ABSTRACT OF EXPERIMENTS ON BRICKS.

The strength is calculated out at 7 in. by $4\frac{1}{2}$ by 3 in.

No.	Make.	Greatest strength.	Mean.	Least.	Weight at 9 by $4\frac{1}{2}$ by 3	Absorbing Power. 24 hours immersion.	Size of Bricks.
		lbs.	lbs.	lbs.	lbs.	per cent.	
4	Boston - - B	6,100	5,064	4,126	9·88	3·6	7·5 by 3·5 by 2·16
4	„ - - - C	4,510	3,184	2,040	8·81	5·9	7·5 by 3·44 by 2·12
2	Baltimore - - B	3,642	3,551	3,460	8·06	10·4	8·54 by 4·23 by 2·31
6	„ - - C	4,146	3,040	1,984	8·12	11·3	8·07 by 3·98 by 2·07
3	Dutch - - -	4,000	3,580	3,016	6·76	-	9·26 by 4·35 by 2·16
4	„ Clinker - -	4,006	2,945	2,457	6·56	-	6·25 by 3·0 by 1·46
9	Wroxeter - - -	4,654	3,435	2,403	-	-	by 3·4 by 1·7
11	Paris - - - -	3,328	2,010	400	7·5	-	8·8 by 4·2 by 2·1
4	„ Hollow - - -	2,360	2,035	1,600	-	-	{ 10·4 by 4·3 by 4·25 / 4·15 by 2·1
10	Calcutta - - -	2,850	1,411	713	6·8	17·5	10·13 by 5·09 by 2·3
1	St. Petersburgh - -	948	948	948	8·1	-	10·0 by 4·8 by 2·8
4	Algoa Bay, South Africa -	1,387	970	555	7·5	-	9·12 by 4·18 by 2·37
3	Tipton Blue - - -	5,553	3,975	2,801	10·0	0·33	8·68 by 4·2 by 3·2
4	made 1849 - -	2,100	2,017	1,970	-	hardly perceptible. -	by 4·2 by 3·2
2	Birmingham — Garrison Lane and Stoney Lane - -	3,530	3,376	3,223	8·5	-	9·12 by 4·25 by 3·18
9	„ „ -	1,300	757	320	7·06	-	9·08 by 4·29 by 3·07
5	Oldbury (Barnsley's) - B	4,600	3,345	2,542	-	-	9·1 by 4·37 by 3·25
11	„ - - C	3,361	2,193	1,121	8·25	-	9·1 by 4·4 by 3·16
9	„ (Ingram's) - M	3,703	3,120	2,078	8·44	-	9·27 by 4·43 by 3·19
5	Birmingham (80 years old) -	3,460	2,294	1,682	8·4	-	8·9 by 4·4 by 2·55
37	„ Vaughton's Hole M	3,286	2,150	724	-	-	by 4·37 by 3·25
22	„ Hand-made H	900	605	421	-	-	by 4·37 by 3·25
6	„ (100 years old) -	4,250	1,923	1,160	-	-	8·87 by 4·33 by 2·25
18	Leeds (Bradley and Craven) M	4,133	3,198	2,616	9·07	-	9·1 by 4·25 by 3·21
3	„ Hand-made - H	1,233	1,038	835	-	-	9·0 by 4·5 by 3·5
4	Bridgwater (Browne) - -	3,200	2,318	1,515	7·06	-	8·93 by 4·25 by 2·65
4	Weymouth (Crickmay) -	2,680	1,940	1,480	7·33	-	8·61 by 4·07 by 2·52
6	„ Common - C	1,152	725	590	7·7	-	9·4 by 4·5 by 2·55
3	Colchester - - -	1,810	1,389	1,050	8·67	-	9·1 by 4·15 by 2·2
9	Leicester White - -	1,472	1,104	842	-	-	9·0 by 4·3 by 3·16
9	Rugby Perforated, about one-third loss - - -	1,222	847	407	-	-	
4	Oxford - - -	1,185	1,087	875	7·9	-	9·0 by 4·24 by 2·64
7	London—first lot - -	1,496	998	366	6·19	-	9·2 by 4·5 by 2·7
7	„ second lot - -	1,396	825	485	6·58	-	8·9 by 4·2 by 2·6
10	Tiles from Mr. Cuthell -	6,900	5,055	3,740	7·35	-	14 by 5 by $\frac{3}{4}$
4	St. Alban's - - -	1,105	961	873	7·63	-	9·14 by 4·29 by 2·6
4	Oldham - - -	1,193	982	898	8·31	9·27	9·1 by 4·4 by 2·9
4	Nottingham - - -	2,142	1,583	1,090	-	$1·5\frac{1}{2}$	$9\frac{7}{16}$ by $4\frac{5}{8}$ by 3

Note.—B means best; C common; M machine-made; H hand-made.

CHIMNEY.

The sketch of the furnace chimney is one I have had working for a long time; it will be perceived that in the interior is a fire-brick lining, 2 feet 7 inches diameter inside, and 9 inches thick. As this is built quite independent of the exterior casing of red brick, a space being left between the two of half an inch, the interior fire-brick lining is at liberty to expand without raising the red brick which surrounds it. Within about 3 feet of the top of the fire-brick chimney or lining is attached a wrought-iron bar, from the end of which is suspended a wire of about a quarter of an inch diameter, which is attached to an index placed about 36 feet below. The index I use is a light one, about 30 inches long, working upon a centre at one end, and having the lifting wire attached to it at a distance of 3 inches from that centre, giving a multiplying power of 10 to 1, so that when the wire is raised by the expansion of the chimney only one-tenth of an inch, the index at its point shows a space of an inch. With this I give the result of six experiments, showing in experiment No. 3 an elongation of 1·425 in., or nearly an inch and a half. In the tables of experiments marked 1, 2, 3, 4, 5, 6, the first column shows the hour at which the coal was put into the furnace, the third column gives the number of degrees as marked by the index. I am aware of the great heat of the furnace chimney for melting iron compared to the heat which is ever obtained in house flues, but since the introduction of hot-air cockles and hot-water furnaces (particularly the high-pressure) the heat of these flues is increased five-fold compared with flues from open fire places; indeed I expect an iron bar might be heated to redness in some of these furnace flues.

EAGLE FOUNDRY, BIRMINGHAM.

Experiments showing the Elongation of a Furnace Chimney when heated. Height of Chimney, 54 ft. 7 in., by 2 ft. 7 in. inside.

Experiment No. 1.—January 28th, 1859.

Hour.	Cwt. of Coal.	Index.	Expansion in inches.	External Degrees Fahrt.	Syphon.	Remarks.
12.50	2 cwt. coal	Zero		47		Clear frosty day.
1.15	10 „ slack			46·25		
2.35	2½ „ slack	65	·325	47·50		
2.57	2 „ coal	108	·54	48		Commenced charging iron.
3.17		85	·42			
3.21		82	·41			
3.30	8 „ coal	80·50	·40			Charging door closed.
4.21	2 „ coal	155	·77	46·50		
4.50	2 „ coal	191	·75			
5.5	2 „ coal	223	1·11	46		
5.12		228	1·14			
5.37	2 „ coal	237	1·18	45		
6.0		237	1·18			
6.5		237	1·18			Commencing second charge of iron.
6.25	8 „ coal	223	1.11			Charging door closed.
7.10	2 „ coal	237	1·18	44		
7.48		257	1·25			

Experiment No. 2.—February 1st, 1859.

1.0	3 cwt. coal	Zero		43		Day overcast.
2.0	10 „ slack					
3.20	2 „ coal	71	·33	42		Commenced charging iron.
4.0	8 „ coal	162	·81	41		
4.50	2 „ coal					
5.18	8 „ coal	149	·74	41		Commenced second charge of iron.
5.47	2 „ coal	170	·85		$\frac{9}{10}$	
6.40	2 „ coal	209	1·02		$\frac{9}{10}$	
7.5	2 „ coal	239	1·17			
7.15		247	1·23			

Experiment No. 3.—February 4th, 1859.

1.0	4 cwt. coal	Zero		46		Day overcast
1.55	10½ „ slack					
3.20		40	·200	46		Commenced charging iron.
3.27	4 „ coal					
4.35	2 „ coal	176	·880			
4.45	2 „ coal	181.50	·905			
4.55						Commenced second charge.
5.10		165	·825			Charging door closed.
5.20	9 „ coal	165	·825	46		
6.35		255	1·275			
7.5	4 „ coal	280	1·400			
7.18		283	1·415	47		
7.45		285	1·425			Rain and wind.

Experiment No. 4.—February 10th, 1859.

Hour.	Cwt. of Coal.	Index.	Expansion in inches.	External Degrees Fahrt.	Syphon.	Remarks.
11.40	3 cwt. coal	Zero.		46		A bright day
12.25	10 „ slack					
1.55	2 „ coal	40	.200			
2.5				50		Commenced charging iron.
2.35		55	·275	50		Charging door closed.
2.40	8 „ coal	53	·265	52		
3.30	3 „ coal					
4.0	3 „ coal					
4.15	1 „ coal					
4.30		202	1·010			
4.45		205	1·025	47		
4.53		208	1·040			
6.0		180	·900			
7.0		142	·710			

Experiment No. 5.—February 16th, 1859.

12.23	3 cwt. coal	Zero		52		Strong west wind.
1.15	10 „ slack					
3.15	6 „ coal	29	·145	52		Commenced charging iron.
4.7	2 „ coal					
4.30		152	·760			
5.15	9 „ coal	176	·880			Commenced second charge of iron.
6.15	2 „ coal					
7.0	2 „ coal					
7.30		243	1·215			
7.40		245	1·225			Rain.
8.0		249	1·245			

Experiment No. 6.—March 14, 1859.

12.30						
1.0	11 cwt. coal	8	·040			
1.30		72	·360			
1.42		88	·440			Commenced charging iron.
1.53		73	·365			Door closed.
2.0		69	·345			
2.50	½ „ coal					
3.0		112	·560			
3.15	2½ „ coal					
3.40		164	·82			
3.42	½ „ coal					
3.45		173	·86			Iron tapped out.
4.15		182	·91			
5.0	19 „ coal	174	·87			Furnace kept waiting more than two hours.
6.0		173	·86			
6.35		173	·86			
7.0		171	·85			
8.0		220	1·100			
8.8	3½ „ coal	227	1·135			Iron tapped out.
8.45	2 „ coal	245	1·225			

Mr. JENNINGS, Fellow, said that no notice had been taken by Mr. Hawkes of the effect of moisture on bricks as affecting their contraction and expansion, nor of the effect on hollow bricks of the improved burning which they obtained in the kiln. He thought perforated were stronger than plain bricks, although so much lighter. Another question which had not been touched upon was the necessary knowledge of the materials, because it was desirable to know what result the clay itself was likely to produce, and how that would be affected by the quantity of sand it contained. If sand had to be mixed with the clay, the question then was as to the respective proportions, and the same applied to the use of breeze. The bricks used for paving annealing kilns could not be laid in mortar, and there was much difficulty in dealing with them. It was desirable to know what bricks would expand least under the influence of heat. He thought much information was necessary in reference to the expansion of the factory chimney referred to by Mr. Hawkes.

Mr. LEWIS, Hon. Sec., said with regard to hollow bricks he had often seen walls built of them, and which, when pulled down, showed that the mortar had had no hold of their surface; and although the holes allowed the mortar to form a kind of dowell, yet the work never in any case under his observation appeared to be sound, *i.e.* where the mortar adhered to the bricks, although the mortar seemed to be good. Even in first-rate work he had seen a wall easily shaken to pieces after it had been built four or five years. The mortar formed a key between the two bricks by the holes, but there was no adhesion.

Mr. RICKMAN, Associate, said that it appeared that just about the same number of bricks to a cubic yard were made within the last few years as had been made just after the great fire of London, 200 years ago, although the bricks have greatly increased in size. The abolition of the duty made a difference in the size, especially in country districts. The finer sort of bricks, if allowed to get damp, send out a green mould, which was very objectionable and could not be remedied. Tipton blue bricks, if used for external facings, let in the wet most thoroughly, either through the brick or the mortar, and therefore walls of that material should be built hollow. He had seen the apparatus used by Mr. Hawkes for testing the expansion of the furnace chimney, and that for registering the amount of heat from the fuel applied by the stoker, both of which were very ingenious. Mr. Hawkes considered that if the fires were allowed to go out, and the chimney to get perfectly cold, contraction would take place, which, when the fires were lighted, would be succeeded by expansion.

Mr. JENNINGS said he had used the Tipton blue bricks in 14 in. and 9 in. walls, and instead of being objectionable they appeared to him to be the best that could be used.

Mr. C. BARRY, Fellow, said the blue bricks used in the north were very good indeed as bricks, but they had the disadvantage of having very little absorption, and the mortar did not thoroughly adhere to them, consequently the moisture made its way through the joints. Mr. Hawkes's paper contained much valuable information, but the tables of the strength of brickwork were, to a certain extent illusory, inasmuch as walls were not built of brick alone, but of bricks with mortar or cement, and the strength of the work must differ according to the mortar or cement. There would be considerable difference between a quick setting cement which became suddenly hard and mortar which took some time to acquire its hardness. The question of the crushing weight was one of very rare practical application, for such a case was hardly known as that of brickwork properly crushing. He only knew of one case in which the work presented the appearance of having been crushed, and that was a building in the neighbourhood of London 250 years old, entirely of brick, which had been built on short piles on swampy ground. The piles were apparently intended to bring the bed for the foundations to an even line, and, upon the piles, planking was laid to carry the walls. This planking, which comprised different kinds of wood,

remained perfectly solid; the brickwork was well done, and the mortar was very good to this day; but in consequence of the works for the Metropolitan drainage, the water below the piles was drained away, and the air getting to them they decayed, and the building had settled, but so gradually and equably, that there was no trace of a distinct crack. On a minute observance of each brick, however, some of them were found to be crushed or permeated by cracks in all directions; besides which, the plaster showed a slight separation from the wall, showing that there had been a subsidence in the whole building. At the new Palace of Westminster experiments had been made on the strength of different kinds of cement. The mode adopted was to stick a brick in cement in the first place against the wall and projecting from it; to this others were added from time to time till the projecting arm broke. In several cases the bricks broke, and a calculation was made of the transverse strain which led to that result. He had no exact memorandum of the result; but, as bearing against the remark made this evening, he remembered that, with pure cement, the joint broke more frequently than when cement was used with one part of sand.

Mr. DINES, Visitor, said the experiments he had made with bricks had been principally with reference to the crushing force. He believed that, when walls gave way, it was more often owing to the mortar than to the bricks. The crushing weight varied exceedingly: good stocks would bear thirty tons, but some bricks would not crush with a pressure of eighty tons. The common place bricks of London would bear five tons; generally speaking hollow bricks were not so strong as solid ones, but, in one experiment, a perforated brick made at Arlsey did not crush under a pressure of eighty-three tons. With regard to sand, unless sand was put into bricks made from the London clay, the bricks would be much smaller, because, without sand, the clay would shrink from 10 in. to $8\frac{1}{4}$ in drying. He believed cracks in buildings were frequently caused by contraction and expansion, as he was quite certain brickwork did expand. At Thames bank the engine chimney was enclosed with a tower upon the outside; these were built so as to allow the inner part to move independent of the outside casing. A guage fixed at the upper part of the chimney showed at times a difference of $\frac{5}{8}$ of an inch in a length of 90 ft. This was caused by the heat of the chimney expanding the inner part, while the outside was at the same time contracted by the cold of winter. He had tried experiments on various descriptions of glass, and had arrived at the conclusion that there was not very much difference in the strength. Sheet glass was stronger than plate or crown glass, but less flexible. Bricks of pure cement, about the ordinary size, would take a pressure of twenty tons, something like a good brick. The want of adhesion of the mortar to the bricks arose from the latter being used too dry.

Mr. C. H. SMITH, Visitor, said that good bricks were of little use without good sticking mortar. The reason that mortar would not adhere to hollow bricks arose from the fact that no brick would adhere to the mortar unless it was coated with a surface of sand. It was almost useless to point a tiled roof, because the mortar always separated from the tile. In machine-made bricks the perforations were made by iron drills, and without putting a coating of sand outside the blocks there never could be sound brickwork; it would be in fact the same sort of thing as building with tiles. It had always been a question among builders, architects, chemists, and others, as to what amount of sand there should be in mortar. The theory that when lime and sand were united the one decomposed the other was a very pretty idea, and at one time he believed it, but eighteen years ago he was induced to make an experiment to test the theory. He obtained a piece of flint (true salica), and having polished its surface, he attached to it some mortar, to ensure the purity of which he made the lime himself from a piece of black marble. Thus the flint was pure salica, and the lime the finest in the world. The flint and mortar thus united he exposed to all the influences

of the weather and temperature for eleven years, namely, until 1854. At that period a lecture on the subject was delivered at the Royal Society, and there, in the presence of Dr. Faraday and Mr. Barlow, he (Mr. Smith) produced his polished plate of flint with the mortar attached to it. He was prepared to find the polished surface penetrated and honeycombed by the action of the lime, but on the contrary, on taking off the lime, which was easily done, it was actually impossible to detect where it had been. He had retained a small portion of this identical piece of flint with the mortar on it, and handed it in for the inspection of the meeting. This experiment proved that there was no chemical attraction between the two bodies, but only the mechanical attraction of cohesion.

The CHAIRMAN, Mr. G. GODWIN, V.P., F.R.S., could not regard the experiment as satisfactory. The lime, as prepared by Mr. Smith, was not mortar, and certainly if mortar with sand in it was applied to a rough, instead of a smooth surface, it would adhere. With regard to chalk lime it was desirable that it should not go forth to the public that chalk lime was as good as Dorking or Blue Lias lime, which was not the case. He remembered the experiments on bricks referred to by Mr. Dines, and particularly the brick that bore 80 tons, but most of them broke with $2\frac{1}{2}$ or 3 tons, and in the district where he was surveyor they generally yielded with 3 tons, and crushing was often seen in the walls. The greater part of the bricks used in the suburbs of London were indeed disgraceful. Why should place bricks be used at all? Why should not every brick be a good one, properly burnt and able to resist a proper amount of pressure. Some of the comparisons drawn by Mr. Hawkes were quite fair, but three tiles of 1 in. thick, each burnt separately, and therefore costing more money, should not be compared with a 3 in. brick. Probably, before the paper was published, Mr. Hawkes would give some attention to the subject of brick-making machinery, for at present there was no machine calculated to produce a good article at a reasonable price. The present state of brick-making was quite a phenomenon. When it was sought to get rid of the duty, calculations were made, and it was clearly shown to the Chancellor of the Exchequer, he (Mr. Godwin) sharing the notion at the time, that good stocks, free of duty, must come down to about 16s. per 1,000, whereas they now cost more than they did before the period referred to. The non-adhesion of mortar to a non-absorbent brick was an important point, and it was most discreditable to build a house with bricks which, after every shower of rain, held thousands of gallons of water, thereby doing immense damage, especially in the country. This state of things was very discreditable, and it was the duty of scientific gentlemen such as Mr. Dines to set themselves to work to meet these difficulties, so that our houses might be dry and healthy, and that the mortar should adhere properly to the bricks.

Mr. C. H. SMITH adverted to the different elements of the materials used for mortar, contending that when the clay, iron, and other extraneous matters were removed, the lime of chalk, Dorking, and Blue Lias was the same in each.

Mr. D. BRANDON, Fellow, said that the use of chalk and stone lime depended much upon the situation and time at which they were used. Thus chalk lime, used immediately, was as good as stone lime. He referred to a wall 90 ft. in length and 4 ft. high, against one side of which the snow had drifted, and where the effect of absorption had been so great as to upset the entire wall, leaving the foundations, however, quite perfect.

Mr. BAKER, Associate, said that, in constructing the new sewer near the Serpentine, the contractor having a superabundance of clay, burnt it and mixed some of it with his mortar, with a very excellent result. That crushing did take place was proved by an accident in Victoria Street, Westminster, where a wall fell down because the brick pier was not strong enough to bear the superincumbent weight.

The thanks of the meeting were voted to Mr. Hawkes and Mr. Lewis, and the meeting adjourned.

STONE PRESERVATIVE PROCESSES.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, January 25, 1861.

The Chairman, Mr. M. Digby Wyatt, Vice-President, said that, with regard to the special business of the night, namely, the consideration of the various processes which had, from time to time, been submitted for the preservation of stone, four years had elapsed since they had an animated discussion upon a paper read on the subject. During the interval, time had been afforded for practically testing the merits of the various processes, and it would be interesting now to learn the actual condition of the surfaces which had been subjected to their action. With this view he invited their attention to the observations which Mr. Tite was about to make.

Mr. Tite, M.P., F.R.S., said, I have to express my thanks to the Council of the Institute for the opportunity they have given me for promoting the discussion of this evening, and, on my own part, for their permitting me to open it. In a meeting like this, composed mainly of professional architects, the great importance of the subject we have met to discuss will be sufficient justification for the step I have taken; for I think, as a profession, we must feel that nothing can be of more importance to us than to endeavour to discover the causes of the failure of the principal material employed in the construction of the Palace of Westminster, and to inquire into what steps ought to be taken to arrest the decay which, at so early a period of its construction, has manifested itself in a manner so marked as to render it an object of European notice and of national regret. A building of vast extent, just finished, built without reference to cost, and, as far as possible in construction, of materials intended to last for an indefinite period of time, and to defy the ordinary causes of accident in ordinary edifices—a building of which we are justly proud as a nation for its combination of artistic learning and science, with the greatest skill of the best of English artificers, acknowledged by all to be the best in the world—and yet, when the sound of the finishing strokes of the axe and the hammer have hardly ceased, it is found externally in a state of lamentable decay. It is true we have seen, and are constantly seeing, in this and other countries, the necessity for restorations, various in extent and character, and many of them due to the same cause as that we are about to consider. And as a proof of this statement I may quote the cases of Notre Dame of Paris, of the Abbey of St. Denis, of the Cathedrals of Chartres, Rouen, and other continental celebrities, or, in our own country, the very familiar ones of Henry VII.'s Chapel and Redcliffe Church, Bristol. But, then, these cases of decay are found after the lapse of centuries, and not of years, and are due to causes perfectly intelligible. Not so with the case before us. Here science and caution have been exhausted, and at the outset no probable reasons for anticipating the result which has followed were allowed to exist, and no expectation of failure could have been reasonably entertained. Under these circumstances I have asked for the present meeting. It is a question which concerns us not only as architects. Though we may not refuse to allow ourselves to be involved in the reproaches which some persons are so ready to be cast upon us on the score of our not being "practical" men, yet we must, amongst the ranks of our profession, have all the experience which exists among living men on the subject, with the technical skill best able to appreciate any proposition which may be made for the amelioration of this great evil. For myself, before proceeding, let me say, I have no personal object to serve, I have no theory to maintain, no likings or dislikings of individuals. I will endeavour to state everything candidly and fairly, and without bias, with a view to promote discussion in the widest and most friendly spirit; and I trust the spirit I desire to show I may be enabled to

realize, and in so doing I feel I shall best promote the object I have in view, viz., the obtaining of some practical and useful result on this much-vexed question.

Mr. Tite then proceeded to observe that the notice placed on the paper suggested that he intended to give some account of the processes used by the ancients for the preservation of stone. If last year he had been told that such a practice prevailed among the ancients he might have been inclined to deny the statement; experience of their buildings induced him to believe that they made no such attempts, because none was necessary in the climate of either Greece or of Italy. That they decorated their buildings, and, in some cases, their statues, with colour, no one could doubt for a moment, but the marble of which they erected their public buildings and houses required no artificial covering to protect it from the ravages of time. Recently, however, notice had been drawn to two processes, one known to the ancients as Zopissa, and the other as Encaustic. With regard to zopissa he could not find that any reference had been made as to its use in connection with stone, but Dioscorides and Pliny had referred, under that term, to some process by which the ancients used to coat their ships. Noah, no doubt, coated the ark, as he was directed, with the pitch and bitumen of the country, and the Greeks and Romans seem to have done the same. In fact, he had no doubt that the process of "paying" vessels, adopted by the fishermen of the present day at Brighton, was precisely similar to that in vogue among the ancient Greeks and Romans. In the 98th chapter of Dioscorides a statement was found that the Greeks scraped the pitch and wax off their old ships, remelted it, and then applied it as paint, by which means it acquired greater resisting power to the action of the water than ordinary pitch. The same stuff was also recommended as a medicine for the cure of boils. Pliny gave pretty much the same account of the process, which it was evident was used exclusively for the protection of ships, and not for the preservation of stone. He now came to the process used by the ancients, and known as encaustic. Vitruvius had left a very full account of the mode in which it was applied. It appeared that they burned marble into a quick lime, and then used it as a plaster, very much as we ourselves did, and, after the third coating, painted the fresco. Vitruvius also described the manner in which white lead and verdigris were made, and any one who had ever been in a white lead manufactory would see that the plan adopted in the present day was precisely similar to that of the ancients, with this exception, that we used tan instead of the vine twigs as mentioned by Vitruvius. With regard to the process which appeared to have been known to the Assyrians, Sir Henry Rawlinson mentioned having met with a solution of Silica, applied to give a finish to the surface on which was described the cuneiform inscription of Darius Hystaspes. This silicious varnish was thus described by Sir Henry Rawlinson:—"It would," he said, "be very hazardous to speculate on the means employed to engrave the work in an age when steel is supposed to have been unknown, but I cannot avoid noticing a very extraordinary device which has been employed apparently to give a finish and durability to the writing. It was evident to myself, and to those who in company with myself scrutinized the execution of the work, that, after the engraving of the rock had been accomplished, a coating of silicious varnish had been laid on, to give a clearness of outline to each individual letter, and to protect the surface against the action of the elements. This varnish is of infinitely greater hardness than the limestone rock beneath it. It had been washed down in several places by the trickling of waters for three and twenty centuries, and it lies in flakes upon the footledge like thin layers of lava. It adheres in other portions of the tablet to the broken surface, and still shows with sufficient distinctness the forms of the characters, although the rock beneath is entirely honeycombed and destroyed. It is only, indeed, in the great fissues, caused by the outbursting of natural springs, and in the lower part of the tablet, where I suspect artificial mutilation, that the varnish had entirely disappeared." The coating described by Sir Henry

Rawlinson could not, in his (Mr. Tite's) opinion, be a varnish, as varnish was composed of gum and spirits of wine, or gum and turpentine, neither of which was sufficient to resist the action of the elements for any great length of time. He fancied that the rocks were composed of sulphate of lime, and that the trickling of the water had produced the appearance described by Sir Henry Rawlinson, and also the polished coating. The carving discovered at Nineveh had, he understood, a somewhat similar coating, which, however, might have been a silicate artificially applied by the ancients at a very early period; and, admitting such an hypothesis, it was a remarkable application of a scientific truth. He would now proceed to consider what, under the present state of circumstances, ought to be done to arrest the decay of stone in our public buildings. The stone we now used was limestone, that is to say, lime bound together by carbonic acid. We found our building stones below the tertiary system, and principally in the oolitic series, such as that found near Bath. The Portland stone was found in one of the upper beds of the oolite. When it was proposed to build the new Houses of Parliament we were not content with the excellent stone which had been tried successfully in other public buildings in the metropolis, but we desired to get a better material. In the words of the Italian proverb, we "were well, would we be better, took physic," and here we are. A royal commission was appointed to select the stone, and, having visited almost every quarry in the kingdom they at last hit upon one between Derby and York, which they fancied to be indestructable. The stone thus referred to was one of the Permian beds of the geologists, composed in about equal parts of carbonate of lime and carbonate of magnesia. From some of the beds of this series most of the magnesia of commerce and medicine was derived, mineralogically it was called Dolomite, for having been first accurately described and separated from the carbonate of lime by Dolomieu, the great French chemist.* An elaborate and able report was issued by the commissioners, and the suggested cause of the failure now appeared to be, that, whereas the stone in its crystalline form is all but imperishable, no stone decays more rapidly in cases where crystallization had not completely taken place. It was evident, therefore, that a great deal of care should be taken in selecting the stone. This remark also applied to other descriptions of stone. The Caen stone, for instance, if well chosen, would last a long time, yet, at Buckingham Palace, it decayed in a few years, whereas a similar description of stone at Rochester Cathedral had stood for ages. The same remark applied to Bath stone and to Portland stone. With regard to the latter, he knew an instance in which the stone brought from the west of the Isle of Portland gave the greatest satisfaction, while that from the Bill of Portland had decayed in a short time. The architect, however, was not to blame, for all he could do was to recommend a certain quarry, and direct that a competent person, like Mr. Smith, should be appointed to mark every block. An illustration of the advantage of selecting the stone with care was supplied in the case of the Geological Museum in Jermyn Street. The stone used there was a magnesian limestone, and it showed no sign of decay, because it had been carefully chosen. (The honourable gentleman then proceeded to make a number of experiments to show in what manner sulphuric acid acted upon limestone, and liberated the carbonic acid).

These experiments were, he said, sufficient to show the manner in which the acid in the atmosphere destroyed our calcareous stone. The extent of the decomposition thus going on was

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* Dolomieu. Déodat-Gui-Sylvain Tancrède De Gratet De Dolomieu. B. June 24th, 1750, at Dolomieu, in Dauphiné, son of François, Marquis of that estate. Originally he was an officer of Carabineers, but, after a life full of adventures, he died at Charolais, November 26, 1801, Professor of Mineralogy in the Musée d'Histoire Naturelle, to which he had been appointed in 1799, whilst he was a state prisoner at Naples. His works are very numerous, and one of his memoirs published in the "Journal de Physique" in 1791, is a letter to M. Picot La Peyrouse, "Sur un genre de Pierre Calcaire, très peu effervescente." "C'est la pierre," continues Cuvier, in his life of Dolomieu, in the 'Biographie Universelle, "que l'on a depuis appelée de son nom La Dolomie."

further proved by the fact that, whereas, in the pure air of Switzerland and Canada, ridges and pinnacles of public buildings, tipped with block tin sent from England, endured in a burnished state for years, the same material would become black and corroded in a few months if used in England. With regard to the remedies to prevent decay, three different kinds had been suggested from time to time, which might be described as bituminous, oleaginous, or partaking of oil and silicious. About five-and-twenty years ago, when some of the great streets in the City of London were laid out by Sir Robert Smirke, a very curious cement, known as Hamlin's, of a very beautiful colour, was brought under his notice, which he eventually adopted. It was composed of sand or ground stone, grey and red oxide of lead, and was made into a paste by the addition of linseed oil. Being curious to know something of the properties of this compound, he submitted a portion of it to Mr. now Professor Faraday, and he told him at once that it was coarse paint, and that, like all paint, it would decay in the course of time. He asked Mr. Faraday to show him how it would go, and, therefore, he stuck a bit of it in a candle, and it blazed away like so much firewood. Experience showed the truth of the criticism. The particulars of several patented inventions for the preservation of stone might be ascertained on reference to the Patent Office. He had obtained several. Of these, the first in priority of date was that of Mr. Bethell, the brother of the Attorney-General, for preserving timber by steeping it in creosote. Mr. Bethell claimed a right to use his invention for hardening stone, but he (Mr. Tite) was not aware that it had ever been applied to that purpose. (See Extract No. 1, page 147.) Next came the patent of Mr. William Hutchison, for making pasteboard and water-proofing for the roofing and sheathing of ships, &c. He also proposed to apply it to stone. (See Extract No. 2, page 148.) Then came the invention of Mr. Daines, which consisted of sulphur boiled in certain proportions with oil. (See Extract No. 3, page 150.) This compound was named in the "Pharmacopœia" as a medicine, under the designation of *oleum sulphuratum*. After mentioning Mr. Daines's, then came the patent of Mr. Szerelmey, dated in the year 1851. (See Extract No. 4, page 150.) Mr. W. E. Newton's patent ranked next in priority, and it might be described as a silicious substance, uniting the inventions of Fuchs and Kuhlman, as set out fully in the Journal of the Society of Arts, of July, 1859. (See Extract No. 5, page 150.) The last invention was that of Mr. Ransome, which was a preparation for the manufacture of artificial stone. (See Extract No. 6, page 151.) Having described at some length the German process, which, he stated, had been successfully applied at Lille, Berlin, and other places, and which consisted in the application of a liquid glass, Mr. Tite inquired whether it might not be possible, in an age so fruitful of scientific results as the present, to apply this water-glass to dry stone, so as to coat and protect it. He confessed that he looked forward with some hope to water-glass being eventually the medium for preserving stone from decay, because he considered that it offered the greatest prospects of success. Before concluding, however, he wished to say that he thought they were much indebted to the late, and to the present Chief Commissioner of Works for the fairness with which they had considered all the schemes recommended to them, and he earnestly hoped that something might yet be done to remove what might be called an architectural disgrace. Mr. Smirke had, in a letter which would be read, thrown out a suggestion that the whole subject should be referred to a select committee of the Institute, to examine specimens and hear the explanations of the various parties interested. Such a committee might, no doubt, be productive of good, and if one or two chemists of eminence were requested to give the committee their assistance it might be more satisfactory. The inventors, whether foreigners or Englishmen, need not, however, be afraid of any injurious results arising to them; for although, in the present state of chemical science, it was absolutely impossible to keep a secret; still, if any inventor had a valuable remedy to offer, he might depend upon being treated with justice and consideration by the Government and the country.

The CHAIRMAN called upon Mr. Lewis, Hon. Sec., who read a communication from Mr. Sydney Smirke, R.A. dated 28th January, 1861, from which the following is an extract:—

"Of the three processes, that of laying on *zopissa* ranks lowest in my estimation. There has been so much mystery and mystification about it, and there has been so much vain boasting about it, that I own I have acquired a prejudice against it which may warp my judgment, and I will, therefore, not say more than that no client of mine will use the zopissa by my recommendation. With respect to the silicification process, it is simple, intelligible, and purely scientific in principle, and if the theory of it can be practically and satisfactorily worked out, it would leave nothing more to be desired. If a thin film of pure silex can be made permanently to adhere to the face of the stone, so transparent as not to affect the colour of the stone, and so thin as not to destroy the sharpness of the carving on the stone, what more do we want? But I have not been yet satisfied that all these desiderata have been secured. It would, indeed, be a triumph of art if nature's process could be so effectually realized. The mechanical deposits of carbonate of lime in the interior of boilers and pipes, of sulphate of lime in stalactites, and the deposit of the salt of lime on urinals, &c., are all *granular at first*, and only become laminated after the process of deposition has been so long continued as to have accumulated a considerable thickness of solid matter on the surface receiving the deposit. These analogies are rather discouraging, and so many years have now passed since the scientific world was first put upon this scent, that I begin to fear that a perfectly satisfactory result is not forthcoming. With regard to the sulphur process, I need not say much; for the results of my experience, such as it is, are faithfully and exactly stated in the printed papers circulated by the inventor of that process.* The 40 yards of experiment on the north side of the Conservative Club are within the reach of everyone's observation, and as far as three and a half years' experience goes the experiment is satisfactory; of this I will only say, *quantum valeat*. Should the discussion this evening result in the appointment of any committee to prosecute this important inquiry carefully and systematically, the Institute may rely on my zealous services, whether on the committee or otherwise."

Mr. BURNELL, C.E., said that as he had devoted his particular attention to the subject, and had peculiar facilities for forming an opinion upon it, he could speak with more confidence than he otherwise should have done in such an assembly. For years past he had been practically connected with the application of building stones, and, in almost every climate in the temperate latitudes of Europe, he had noticed the different ways in which they had decayed. Since his return to England his attention had been especially engaged by the decay which had occurred in the Houses of Parliament, a building which was the honour of our modern architecture, and in which (as Mr. Tite said) it would appear that all modern resources of science had been exhausted, but which was no sooner completed than the exterior had begun to decay. It struck him that the whole question in hand started upon the serious mistake of directing attention to the preservation of stone, instead of having, in the beginning, addressed themselves to the choice of a stone which would not decay. Although they had been in possession of a stone (Portland) which had, for ages, resisted the London atmosphere, they would go further afield and find something better; and thus arrived at the present sad result.

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* I certify that about two years ago a portion of the masonry of the north front of the Conservative Club House was, by way of experiment, treated according to Daines' process. The surface of the Caen stone (which showed manifest symptoms of decay) was scraped before the preparation was applied. I have since repeatedly examined it, and up to the date hereof not the slightest signs of decay appear, the arrisses remain perfectly sharp, and the face still bears the marks of the scraper quite unaltered. The portion of masonry above referred to can be readily examined by any one from Little St. James's Street.—SYDNEY SMIRKE.

Grosvenor Street, August 25, 1859.

With regard to the resistance of building stones exposed to atmospheric action, it was well known that their crystalline condition had a remarkable bearing upon the question. Crystalline stones did not decay in anything like the same ratio as stones of an earthy or amorphous texture. The building stone which was experimented upon, and which formed the basis of the Parliamentary Report, was of the magnesian limestone series, being a crystalline carbonate of lime and magnesia, or real dolomite; whereas the stone actually used had not been the crystalline but the amorphous dolomite. This was the first cause of the decay; but the question now was, what ought to be done. The amorphous stone which had been used was decaying rapidly, in consequence of the sulphate of ammonia in the London atmosphere acting upon the instable carbonate of magnesia, and so forming a sulphate of magnesia, which, efflorescing over the surface of the stone, produced disintegration. And he believed it would be found that the decay was going on, not where Mr. Faraday had sought for it, namely, where the moisture immediately fell, but in the zone where the capillary attraction ceased, or rather where capillary attraction only occasionally was going on. Mr. Faraday* had alluded to the large cavetto moulding of the plinth of the Houses of Parliament, as the site of the decay; but he (Mr. Burnell) did not think the decay would display itself the most seriously there, but rather in the straight part of the plinth under the cavetto moulding, and just about the zone where the capillary action of the stone above the plinth would allow the moisture to affect the face of the stone. The efflorescence in fact took place between wind and water, and not in the part which was constantly wet. Decay had not taken place in the projecting string courses upon which the wet would fall, but in the small bends of the lower parts of the Gothic label mouldings, which had gone infinitely more than the inclined face at the top. It appeared in the line under the label mouldings of the parapets, but not in the top mouldings of the parapets themselves. In all the building there had been a disintegration of the mollecules of the stone in those alternately wet and dry portions, in consequence of the action of the gases in the London atmosphere, and the question was, how to resist that effect. Having the decayed stone to deal with, the only remedy seemed to be to present some kind of cementing material which should artificially prevent the disintegration. He had watched this subject very closely, and it would be found that wherever the stone had been hermetically closed in any way, the process of efflorescence, or throwing out the different salts, had taken place to such an extent as to throw off the different coatings applied, and the stone had gone on decaying underneath. Mr. Faraday had particularly referred with approval to the Speaker's Court; but within six months after the publication of Mr. Faraday's Report,† that Court was coated over again, and to his knowledge it had been coated three times since, and the result was that an exfoliation of these different coats was now going on, and fragments thrown off of the size of the finger nail might be picked up from the pavement round the Court. The magnesian limestone of the Houses of Parliament had now been exposed for a number of years to the London atmosphere, and the absorption of the sulphate of magnesia had been going on all the time. Then the chemical actions necessarily incident to the absorption of the sulphate of ammonia must take place, and the products could not throw themselves out towards the interior of the walls because the thickness of the brickwork behind the Ashlar opposed itself to that action. Consequently the efflorescence must, almost forcedly, take place outwardly, and especially at the sides, exposed as they were to the sun-light and the sun's heat, because the atmosphere acted especially upon those faces. By the application of the coatings which were supposed to close the pores to outward influences, the cause of evil was shut up in the stone, and its natural effects were much interfered with; and it was not therefore surprising that in all the Courts at

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* Vide page 174.

† Vide pages 173 and 174.

Westminster the impermeable coatings were being thrown off, whilst in some cases the stone underneath might be seen following the same course. He alluded especially to these defects because Mr. Bidder, himself, and others, had inserted a letter in the "Times," stating that Mr. Szerelmey's process had been applied a second time in consequence of the decomposition. To this Mr. Szerelmey had replied, stating (though not exactly in those words) that they did not know exactly what decomposition meant. The real question, however, was, having a material which had been employed, and which had already absorbed the causes of decay, how was it possible to counteract them? He believed the only method, as he had said before, was to present some kind of ingredient to bind together the earthy particles by some insoluble cement. What was to be its nature? He firmly believed that a precipitate of the silicate of lime was the only one which, in the present state of the arts, they were able to command for the purpose. As for bituminous matters, they all knew that, when exposed to atmospheric action, they decayed and decomposed within a very short time. Paints also decayed and decomposed by the same rule; and at present he knew nothing which would have an affinity with the materials in building stones, or which could be properly introduced, excepting the silicate of lime. There were difficulties in the introduction of these matters. If it was attempted to try them on a stone saturated with moisture, they would not go in, or would be thrown off by the first frost. Their application was, indeed, a chemical question, requiring skill and careful manipulation, and, unless properly applied, they were as likely to lead to failure as to success. The whole question, indeed, was still involved in very great doubt and obscurity; but he had a very strong conviction that of all the processes he had yet seen, Mr. Ransome's was about the best; at the same time he should be sorry to pin his reputation upon that or any other process until much more extensive experiments had been made.* He was convinced that Mr. Sydney Smirke's suggestion ought to be adopted, and that the whole question should be referred to a committee of men who were likely to know the conditions under which the decay took place, and who should be able to guide the chemists in the class of investigations they might require to go through. Hitherto chemists had only been named to inquire into matters which were within the scope of an architect's duties. The proper mode of conducting the inquiry would, however, be to carry it on in such wise that the chemists should keep the architects right in matters of science, but in which the architects should guide the chemists in the investigations necessary to be gone through. The whole subject was one which essentially required to be examined by a joint committee of architects and chemists.

The Chairman said that, as they must all feel an intense interest in the preservation of the great work of Sir Charles Barry, it would be a gratification to the meeting if the Chief Commissioner of Her Majesty's Works, being present, would favor them with his views as to the proper steps to be taken by Her Majesty's Government on the subject.

The Right Hon. W. Cowper, M.P., Chief Commissioner, said he had been much gratified by hearing the able paper of Mr. Tite, and he thought the subject had been worthily taken up by the Institute, because in the state of difficulty in which those were placed who had the custody of the Houses of Parliament, they looked for guidance and help in the matter. Being himself officially in the responsible position of having the care of that magnificent building, he was anxious to get all the advantages which science and experience could afford. When he first had to consider the subject he always looked to Sir Charles Barry, and had found him exceedingly anxious that something should be

* Subsequent experience has induced me to modify, very seriously, the opinion thus expressed; and to induce me to consider that this process has little *permanent* superiority to the ordinary protecting coats applied to stone. I hope to be able, in the course of the next Session, to communicate to the Institute the result of a series of experiments and investigations recently made upon the physical nature of building stones.—*G. R. Burnell.*

done with reference to the preservation of the stone, because he had evidently become aware that the stone which he was instrumental in selecting had not attained the object he expected; and it seemed that he had formed an opinion favorable to the composition of Mr. Szerelmey, believing it to be the best known process. Accordingly, under his advice, and after the examination of Mr. Faraday and Sir Roderick Murchison,* he (Mr. Cowper) had thought it his duty to apply the Szerelmey process to some portions of the building which Sir Charles Barry had pointed out as wanting immediate preservation. His own opinion, however, was, that this process was not one which could be confidently applied to the whole building, and he would much rather wait and see what competent and scientific men could recommend. He, for one, should be very glad if a committee of the Institute should go very fully and carefully into the subject. From what he had been able to gather, and the idea had been very much confirmed by Mr. Tite's able lecture, he believed the application of water glass would be the direction in which they would be most likely to find what they wanted. The water glass had been applied experimentally to a portion of the river front some years ago, but they knew very little as to the manner in which it was applied, and it could hardly be regarded as a satisfactory test. The same solution was now being used on the frescoes in the House of Lords, and he believed with the greatest satisfaction to the artists who were applying it. Without entering into the scientific branch of the subject, he would only say that the Government were looking to a satisfactory means being found of preserving this magnificent structure. The remarks of Mr. Burnell, as to the places in which the decay occurred, had hardly before met with sufficient attention. The decay was not widely diffused over the whole building, but ran along it in particular streaks. He was sure the Government would be very glad if something could be demonstrated upon the subject, and also that Parliament would feel great satisfaction in having anything clearly stated, upon the credit of the science, skill, and knowledge of the country, as affording a real prospect of preserving the Houses of Parliament from that decay which was at present so rapidly advancing.

Mr. G. G. Scott, Fellow, had great pleasure in moving a vote of thanks to Mr. Tite, who had brought the present subject forward in as complete and fair a way as possible;—and in using the word *fair* he intended to intimate that it was better that such a subject should be brought forward by one who had an opinion upon it, than by one who had no particular view of his own; because it afforded to those who differed from that view an opportunity of expressing their opinions. Mr. Scott proceeded to state that, under his directions, the masons of Westminster Abbey, during a period ranging from about five to two years ago, had tried a long series of experiments† on different decayed portions of the Abbey; embracing nearly all the processes which had been mentioned by Mr. Tite. He added that if any members of the Institute wished to examine the work treated by these processes, every facility for doing so would be afforded them by Mr. Poole, of Great Smith Street, the master mason to the Abbey. None of the experiments which had been tried, however, appeared to him to have been thoroughly satisfactory; some having entirely failed, and others in a slighter degree. Possibly they might all have been tried under unfair circumstances, certainly under great disadvantages, as they were mostly applied to bad Caen stone which was in a rapid state of decay. He concurred in the appointment of the proposed Committee, especially as the standing Committee appointed four or five years ago, had only met two or three times, and had never made any report; but he begged to suggest the desirability of seeking for united action in the proposed Committee between the Institute and the Institution of Civil Engineers,—both bodies being nearly interested in the result, whilst possibly some members of the latter, from their particular line of practice, might be eminently fitted

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* Vide their Report, pages 173 and 174.

† Vide page 146.

to form an opinion on the subject. A Committee of the two Institutions, with the aid of eminent chemists, would, he thought, be more likely to produce a satisfactory result than a Committee of either body alone. He would take the present opportunity of urging a point which had never been publicly noticed; namely, that they ought not to saddle the failure of the stone in the New Houses of Parliament upon the Commission of scientific men who recommended it for adoption. The stone of which the Houses of Parliament were built was *not* in fact the stone recommended by the Commissioners. There was a slight error, however, in the Commissioners' recommendation. Seeing that the Norman west front of Southwell Minster had stood for so many centuries, and remained in such a high degree of preservation, they believed that the stone of which it was built would answer the intended purpose, and they believed they were right in recommending the stone of the Bolsover quarries accordingly. But on opening a quarry at Bolsover they found it contained no stone of anything approaching to sufficient size for the Houses of Parliament, and therefore they opened another quarry, a few miles off, at a place called Mansfield Wood House.* It had since been found, on almost certain evidence, that the Mansfield Wood House stone, and not the Bolsover, was really the material used in Southwell Minster, and *intended* to be recommended by the Commissioners. Many of the lower portions of the Houses of Parliament had been executed with this Mansfield Wood House stone, and it had been pointed out to him by a respectable mason, who was employed on the earlier works (and he was himself able to verify the statement), that the stone from these quarries had stood much better than that from Auston. The Commissioners' Report, therefore, had virtually stood the test of time, and the present unhappy result had arisen by departing from that Report. Mr. Scott referred to the Martyr's Memorial at Oxford, respecting the stone for which there had been a difference of opinion among members of the Building Committee,—some parties advocating the fine grained but cold Roche Abbey stone, and others (on the faith of the Commissioners' Report) the beautiful warm-coloured Bolsover stone. This difference of opinion had led him to suggest that, by examining the quarries of the district a stone might be found uniting the fine texture of the one with the warm hue of the other, and he found exactly such a stone in an ancient and long disused quarry at Mansfield Wood House, a quarter of a mile from the quarry then being worked for the Houses of Parliament. He believed this to be the finest stone in this country, though from the great cost of quarrying and working it, it was only capable of being used for small and delicate purposes. It was adopted with perfect success for the Martyr's Memorial. At the next meeting he hoped to offer some more lengthened remarks on the subject generally.

Mr. Godwin, V.P., F.R.S., seconded the vote of thanks to Mr. Tite, and ventured most respectfully to urge the Chief Commissioner of Her Majesty's Works to persevere in his intention to wait. He believed that every one who had lately examined the Houses of Parliament would agree with him that their appearance was most distressing. The effect of the experiments had been that the building looked in parts as if it had been white-washed,—or even worse; and if the whole of the surface were to be so treated they might just as well have had compo Houses of Parliament. Without due caution all the money spent would be wasted. Her Majesty's Government would, therefore, do well to pause till they had got the report of some disinterested committee. Hitherto the misfortune had been that the discussion had been carried on mainly by interested parties; and the scientific men who had advocated the different processes, had reasons for seeing things in a particular way, and they had not arrived at a result which could be depended upon. When Mr. Burnell read a paper on the subject at the

* This quarry had been largely worked in ancient times, a large surface being found partially quarried over, but its use had long been discontinued.

Society of Arts, he (Mr. Godwin) said that before any of the processes could be adopted time must be given to prove their utility, and he felt the necessity of that now more than ever.

The CHAIRMAN said that while the Council would feel it a pleasure and an honour to assist Her Majesty's Government or the House of Commons in any way in which they could be useful in this subject, he thought it right that public expectation should not be built too much upon the report of any Committee whatever. It was mainly a matter of invention, and the Committee would only be investigators,—not inventors. He himself thought the best Committee would be one appointed by the House of Commons, embracing architects, engineers, and men of science. So far as the Institute was concerned very valuable information had been already afforded by Mr. Tite, Mr. Burnell, Mr. Scott, and others, who had given much thought and study to the subject.

The vote of thanks to Mr. Tite was carried unanimously, and the discussion on his paper was adjourned.

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*Processes as applied to rapidly-decaying Stone in Westminster Abbey.**

I. *The Water Glass.*—Tried in 1857 and 1858. The effects still remain, and the stone is a good deal hardened; and the decay, in part, arrested, but by no means perfectly.

II. *Mr. Paul's System.—Aluminate of Potash.*—Tried in 1857 and 1858. About the same in all respects as the water glass.

III. *Mr. Ransome's System.—Silicate of Lime.*—Tried in 1857 and 1858. Not very different from the above. The stone is hardened, and decay in part arrested, but not perfectly.

IV. *Mr. Szerelmey's Process.*—(This is placed under the head of Silicates, on the faith of the statement made to Dr. Faraday, though Mr. Szerelmey's pamphlet would lead to a contrary classification). Tried in 1859. Stone much hardened; effects remain, though apparently diminished; decay only in a small degree visible.

Experiments have also been made on a somewhat extended scale, both with the soap and alum, and with Rochas' silicate. The effects of the soap and alum appear to have ceased; those of Rochas' system remain, but I am not able to judge well of its efficiency.

Resinous and Oily Processes as applied to rapidly-decaying Stone in Westminster Abbey.

I. *Solution of Shell-lac in Spirits of Wine.*—This has answered admirably for internal work, and also for work in the open air, defended against rain, but has not answered where exposed to rain; though, in some cases, where used upon plain ashlar faces, it is pretty perfect. It has been used internally for between four and five years; and a few external specimens for between three and four years.

II. *Solution of White Wax in Turpentine.*—Has been tried for about three or four years, but has failed.

III. *The same, with the addition of Stearine.*—Has answered better, but is failing.

IV. *Mr. Daines' Process, Oil and Sulphur.*—Has been tried since July, 1859. It has hitherto answered almost, though not quite, perfectly: the stone is very much hardened. One specimen shows a little failure under the projecting coping.

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* Vide page 144.

EXTRACTS.

BETHELL'S SPECIFICATION.—No. 1. A.D. 1838. No. 7731.

My invention of improvements in rendering wood, cork, leather, woven and felted fabrics, ropes and cordage, stone and plaster or compositions, either more durable or less pervious to water, or less inflammable, consists in impregnating such articles with various mixtures or solutions, whereby they are rendered either more durable, less pervious to water, or less inflammable, according to the different mixture or solution with which they are impregnated.

First, as to the various apparatus or means for more thoroughly impregnating the above-named articles with the mixtures or solutions hereinafter described. These forms and apparatus are constructed for the purpose of forcing the various mixtures or solutions hereinafter named into the interior of the above-named articles, either by means of hydrostatic or pneumatic pressure, aided in some cases by exhausting the pores of the articles of the atmospheric air contained therein, or by boiling the articles in vacuo: or, as to wood, by placing the butt ends of trees, immediately after they are felled, in vessels containing the solutions of the first class hereinafter described, so that the solutions may circulate with the sap throughout the interior of the tree, and thus thoroughly impregnate the wood. The various apparatus I will now describe. An air and water-tight vessel or tank must be made of strong metal, of any form that may be preferred (one made like the circular wrought iron boilers for high-pressure steam engines answers very well) strong enough to withstand an internal pressure of two hundred pounds to the square inch, having a lid or door to it, which is made to screw on air-tight. The tank is fitted on the top with a common steam-boiler safety valve, and it is connected by one pipe having a stop-cock or valve in it with an exhausting air pump, and by another pipe likewise fitted with a stop-cock, with a pump for forcing liquid into the tank made like the pump for forcing water into the hydrostatic presses, &c., &c., the lid screwed on air-tight, the cocks in the pipes leading to the pumps being shut; the tank is then filled with the desired mixture or solution through a pipe having a stop-cock in it, which is then shut, and the cock in the pipe leading to the air pump being opened, that pump is set to work for the purpose of exhausting or drawing the air out of the tank, and also out of the pores of the various articles, after which the liquid, mixture, or solution will penetrate into and fill up those pores before occupied by the air, more particularly if the tank is kept heated, which may be done in any convenient manner. But for some articles this may not be found sufficient, and in such cases the air pump, after having exhausted the tank, is stopped, the cock or valve shut, and the liquid force pump set to work (its cock being previously opened) to force some of the same mixture or solution into the tank until the required degree of pressure is obtained.

Secondly, as to the mixtures or solutions to be used with either of the above forms of apparatus for impregnating the various articles. To describe these more clearly I have divided them into three classes, the first class containing such as are applicable to render certain of the articles above named more durable; the second class, such as will render all the above-named articles more durable and less pervious to water; and the third class, such as will render them less inflammable.

The First Class.—For Wood.

Number 1. Solution of sulphate of iron. One pound of the salt to be dissolved in two or three gallons of water, and to be used as soon as dissolved, or the pyroligneous iron liquor used by dyers mixed with about half its quantity of water.

2. Sulphate of copper. One pound of the salt dissolved in three or four gallons of water.

3. The waters of copper mines, and also the waters of streams or brooks in a copper country which contain copper suspended in solution in them.

4. Choride or chlorate of copper. One pound dissolved in four gallons of water.

5. The yellow chromate of potash. One pound dissolved in four gallons of water.

6. Refuse lime water from gas works. This liquor must be allowed to rest for several days until the lime is precipitated to the bottom, when the supernatant liquor may be drawn off and used to impregnate wood.

The Second Class.—For Wood.

Number 7. Any mineral tar or bitumen, or any vegetable tar mixed, when necessary so to do, with any volatile oil or spirit to thin it sufficiently to penetrate the articles of which it is to be used, and to which may be added a portion of caoutchouc or black rosin, which is incorporated therewith by heat.

8. Coal tar obtained from gas works, thinned with from one third to one half of its quantity with the essential oil or spirit obtained by the distillation of the coal tar. That which I use is the common spirit left after the naptha is obtained, and commonly called in the trade "dead oil." Either caoutchouc or rosin may be added to this mixture if required, by dissolving the caoutchouc or rosin in the coal tar and oil by heat, or by adding the well-known caoutchouc paste or varnish to the tar and oil, heating the mixture and stirring it well until the caoutchouc is thoroughly mixed with the tar. From one quarter to half a pound of caoutchouc, or half a pound of black rosin to one gallon of tar and oil, may be used; but it will be necessary that more of the dead oil should be added to thin it sufficiently to penetrate the wood, &c.

Number 9. Vegetable tar, as Archangel or Stockholm. These tars contain an acid which is injurious, and therefore before using them I free them from it by agitating them for some time with lime water, or by throwing into the tubs or vessels in

which the tar stands a quantity of old rusty iron or iron slag, and this prepared tar is then mixed with the above-named dead oil, or with the spirit distilled from itself; but I prefer the dead oil, as it is cheaper. Caoutchouc or rosin may be added thereto if desired, in manner described in No. 8.

Number 10. Whale oil, cod fish oil, or any other fish oil, mixed with from one third to one half of dead oil.

11. The same as Number 10, with the addition of sulphur, as three ounces of sulphur dissolved by heat in every gallon of the mixture, Number 10.

12. Boiled or drying linseed oil mixed with oil or spirits of turpentine.

13. Boiled or drying linseed oil, to which caout. paste is added, as about one half pound of caout. paste to every gallon of linseed oil.

14. Rape oil, in which caout as No. 13.

15. Spirits of naptha, in which caout. as No. 13.

16. Bees-wax dissolved in spirits of turpentine.

The Third Class.

Number 17. Soluble glass dissolved in water, in proportion of one pound to five or six gallons of boiling water (soluble glass is well known, and the mode of making it is fully described in several chemical and other books).

18. Four pounds of alum, eight pounds of potash or soda, two pounds of borax, and four ounces of glue of starch dissolved in twenty gallons of warm or boiling water; the articles to be dissolved in the water in the order in which they are named.

All descriptions of porous stones, such as Portland stone, free stone, chalk, some marbles, and plaster of Paris, or such compositions as are made with burnt clay, or with plaster of Paris and cements in imitation of plaster or stone, are to be impregnated in manner above named with the solutions No. 1, 2, or 3 of the First Class to render them more durable, and with either of the mixtures of the Second Class to render them more durable and less pervious to water. For Portland stone, free stone, chalk, or any other porous stone, No. 8, 9, 10, or 11 may be used. Statues or architectural ornaments made of Portland stone or free stone when impregnated with these mixtures will become infinitely more durable, and if the colour is objected to they can be afterwards painted or coloured in any colour that is desired; marble ornaments or statues when impregnated with either of the mixtures No. 11, 12, 13, 14, 15, or 16, will resist the injury generally caused by exposure to the weather, and become more durable and less pervious to water, which, congealing in its pores by the frost, causes it frequently to crumble away. Statues or ornaments made of plaster of Paris, or with the compositions above mentioned, must be impregnated with either No. 1, 2, and 3 of the First Class, or with either No. 10, 11, 12, 13, 14, 15, or 16 of the Second Class. Bricks impregnated with either No. 7, 8, or 9 would be very durable and less pervious to water, and useful for many purposes, particularly for building foundations of houses or cellars in damp situations, or for paving the streets, the joints being made with asphalte or bituminous matter instead of common lime mortar. All the articles above named may be, rendered less inflammable by impregnating them in manner above described with either of the solutions of the Third Class No. 17 or 18.

HUTCHISON'S SPECIFICATION.—No. 2. A.D. 1847. No. 11,979.

The proportion in which the substances, matters, or things composing the solutions are admixed together are changed and varied, according to the character of the substance under treatment, as follows:—For pasteboard seventy-five parts of resin or pitch, and twenty-five parts of oils, tallow, or any other greasy matter, with the addition, together or separately, of pounded stone, chalk, slate, &c., thoroughly dried, and then mixed therein as required, will produce, after exposure to the action of cold air, a flexible but compact and impervious substance for the purposes of sheet roofing, sheathing of ships, railway and other carriages, pipes, tiles, &c., and will effectually resist the action of the air, water, frost, vermin, and other destructive agents. Paper, old rags, hemp, flax, jute, tow, ropes, and cordage, even hay and straw, or other vegetable matter, either mixed together or not, and formed into a substance, being prepared for that purpose by being boiled or mashed together, and then shaped to the desired form, afterwards thoroughly freed from all moisture, and submitted to the above boiling solution, will produce a similar result, as above stated. Soft and porous wood for railway sleepers and many other purposes, is treated in a similar manner, the proportions of the boiling solution being seventy parts pitch or resin, and thirty parts of oils, tallow, or any other greasy matter, kept boiling during one hour if a quarter of an inch thick, and so on according to the substance thereof. Plaster, plaster of Paris statues, busts, and all ornaments made therewith, also chalk and alabaster, also all porous art manufacture made of clay or other absorbent material, is or are treated with boiling solution, proportioned thus: seventy-five parts pitch or resin, and twenty-five parts oils, tallow, or fatty matter, coloured with vegetable or mineral matter as before stated. With regard to plaster and plaster of Paris great care and precaution must be adopted in gradually drying them, taking care that previous to submitting them to the boiling solution they be not heated too much, sixty degrees being found the most suitable, also taking care not to continue them in the above boiling solution too long, say from one to two hours, and so on in proportion to cubical contents. In case of soft porous stone, such as sandstone, the proportions of the boiling solutions consist of ninety parts pitch or resin, and ten parts oils, tallow or fatty matters. For comparatively hard and compact stones, such as the oolitic and porous marble, eighty parts pitch or resin, and twenty parts oils, tallow, or fatty matters, coloured with vegetable or mineral matter, as before stated, if required. And it is advisable with regard to the more porous kinds of stone, such

as sandstone for instance, which would not be easily workable without being first dried, to proceed by drying them, then working or fashioning them, and afterwards drying them again before treating them with the composition or compositions, solution or solutions, as before described. When the stone or other substance under treatment has become so dry that no vegetable moisture remains therein, which can be ascertained by striking it, when, if it be perfectly dry, it will give forth a ringing or metallic sound, it is then in a fit state to be subjected to the action of the particular solution suitable under the circumstances of the case, as hereinbefore described, for the purpose of hardening such stone or substance and rendering it impermeable or impervious to water, air, and frost, and impenetrable to the attacks of vermin, and other destructive agents. Wrought iron or copper tanks should be always used to boil the aforesaid solution or solutions in, and they should have lids or covers to them, with distillating pipes proceeding therefrom to carry off the spirit and gases generated, and to deposit the same in a suitable reservoir or suitable reservoirs. All the substances herein named, when submitted to the above process or processes, should be laid carefully in a suitable metal frame, each part separated from the other, which should be lowered into the proper solution (kept boiling previous to and during their immersion therein) either by a crane or other convenient mechanism, raised in same manner, and lodged thereby in such boiling solution till the surface is freed from the the superfluous matter, and then withdrawn and exposed to the action of cold air, which effectually indurates them, and renders them impervious to atmospheric action, vermin, and other destructive agents.

TESTIMONIALS.

As no one on behalf of Mr. HUTCHISON took part in the discussion, these letters have been added for the information of the Members.—

SIR RODERICK MURCHISON TO W. HUTCHISON.

St. Aubyn's, Tunbridge Wells, November 14th, 1853.

SIR,—Believing that your method of Indurating the soft Sandstone of this neighbourhood, and of rendering a material which is so easily worked, as durable as the hardest rock, and quite impenetrable to moisture, I sincerely wish you may have that success to which you are justly entitled.

It is, indeed, manifest that, in a climate like this, a cheap building stone which throws off wet and never can absorb it must be highly valuable, not only in the construction of houses, but in all hydraulic, paving, and monumental work.

When I further know that every sort of decoration can be chiselled out at the very slightest expense, and with great rapidity, and that in a few hours the material can be rendered an indestructable rock, with edges that can only be destroyed by violence, and never can be affected by the weather, I conceive that your patent only requires to be known in order to be generally appreciated.

Wishing you every success, I remain, yours faithfully,

RODERICK MURCHISON.

(Copy.) Tunbridge Wells, December 22, 1849.

Mr. Hutchison having applied to me for a Testimonial in favour of his process for Indurating Stone, I have much pleasure in stating that from experience I can testify to its exceeding usefulness. For paving, kerbs, drainage, foundations, or any other purpose where durability and impenetrability are required, I consider the indurating process invaluable.

The soft and very friable sandstone of this neighbourhood, when indurated by Mr. Hutchison's patent, is equal to the hardest stone, and appears to have almost a metallic character. It has been used for belfry steps, at the new Church erecting here under my superintendence, and I have also used it for paving, sinks, &c., and for the purposes above-named do not hesitate to give it unqualified approval. The process is also of considerable advantage in the decorative portions of building, such as chimney pieces, &c., as the stone, when indurated, will carry an excellent polish.

I am convinced that this simple but efficacious process only requires to be thoroughly known to be appreciated and extensively used.

(Signed) EDWARD N. STEVENS, ARCHITECT.

ADDITIONAL TESTIMONIAL FROM SIR RODERICK MURCHISON TO MR. W. HUTCHISON.

London, 18, Jermyn Street, March 14, 1859.

Sir Roderick Murchison will call next Saturday, at half-past Eleven, to inspect the specimens of the Indurated Stone Works in Great Russell Street.

He has before recommended this stone for certain purposes to the Architect of the British Museum, and has seen no reason to change the opinion given in 1853 respecting its durability and resistance to moisture.

Mr. Hutchison, Indurated Stone Works,
Tunbridge Wells.

DAINES'S SPECIFICATION.—No. 3. A.D. 1854. No. 1765.

Extract from Provisional Specification left by the said John Benjamin Daines at the Office of the Commissioners of Patents, with his Petition, on the 12th August 1854. (No. 1765.)

The chief object of this Invention is to impart to the exterior surfaces of stone and compo buildings the powers of resisting the destructive effects of the atmosphere and of damp. To this end, when operating upon a porous stone or cement, I first apply a solution of sulphate of zinc, or a solution of alum, or other suitable inorganic body, and thereby fill the pores and neutralize the tendency to alkaline efflorescence. I then, by the aid of a brush, or by means of an exhausted case applied to the wall of the building, coat the prepared surface with a cold solution of sulphur, obtained by the use of linseed oil or other suitable solvent, not incompatible (like acids) with the nature of the material under treatment, and the stone or other material will then be impervious to moisture, and even susceptible of taking a polish, if such were desired. This Invention, it will be understood, is applicable to the preservation from decay, and also to the embellishment, of a variety of articles composed of stone, plaster, or cement, as well as the interior walls and floors, and ceilings of buildings.

Extract from Specification filed in pursuance of the conditions of the Letters Patent and of an Order of the Lord Chancellor, by the said John Benjamin Daines, in the Great Seal Patent Office on the 19th April 1856.

This Invention relates to a certain mode of treating the surfaces of stone, brick, and composition buildings, for the purpose of enabling them to resist the destructive effects of the atmosphere and damp, and thus preserving the same from decay. To produce these results I employ a solution of one part by weight of sublimed sulphur in eight parts of linseed or other oil. These ingredients are placed in an earthen vessel, and heated in a sand bath to a temperature of 226° to 278° Fahrenheit, when the sulphur is dissolved. This solution, when cold, is to be laid on the surface of buildings or building materials by means of a brush or other suitable means.

What I claim under the above in part recited Letters Patent is, the use of a solution of sulphur in linseed or other oil prepared substantially in the mode described, and applied to the purposes specified.

SZERELMEY'S SPECIFICATION.—No. 4. A.D. 1857. No. 23.

Extract from Provisional Specification left by the said Nicholaus Charles Szerelmey at the Office of the Commissioners of Patents, with his Petition, on the 2nd January 1857, and Specification, 2 July, 1857.

This Invention has for its object improvements in preparing combinations of materials for rendering walls and other structures waterproof. For these purposes, what may be called improved Greek cements, are produced in the following manner:—

About 12 gallons water,
„ 2 gallons blood,
„ 25 lbs. ground bricks,
„ 12½ lbs. of powdered copper slag,
„ 12½ lbs. of powdered iron slag,
„ 16½ lbs. of argillaceous earth,
„ 6¼ lbs. of caseous matter (produced from milk).

These matters are boiled together for about two hours, and this is called compound or preparation No. 1.

In order to prepare another, or second preparation or compound, the following matters are employed:—

About 10 lbs. of gas or coal tar, or sometimes in place thereof linseed oil, at other times rosin or asphalte,
„ 6½ lbs. of hydraulic lime,
„ 6½ lbs. of grit,
„ 6½ lbs. of calcined flint.

These matters are boiled together in a suitable iron pot for about three hours; they are then, by means of an iron ladle, transferred to a second iron pot, in such manner that the air may come freely in contact, and after the mixture has been allowed to cool it is again boiled until it spontaneously bursts into combustion, and after it has burned for a very short time the fire is extinguished by means of a close fitting cover; this combination or preparation I call No. 2.

These cements, though they may be capable of separate use, are preferred to be employed in succession on the wall or other structure.

NEWTON'S SPECIFICATION.—No. 5. A.D. 1841. No. 8914.

This Invention, communicated to me by a Foreigner residing abroad, consists:—

Firstly, in the formation by certain new processes of an hydraulic lime and cement, which has the property of becoming hard and solid when under water or exposed in damp situations.

Secondly, in the application of the same principles to the hardening of soft stones for the purpose of making hard artificial stones.

Thirdly, in the employment of the same process for hardening wood and preserving iron from the effects of damp, &c.

The following is the principle upon which the Invention is founded, and the methods employed for carrying it into effect:—

The property which certain sorts of lime possess of being hydraulic, or hardening under water, is caused by a certain combination of the lime with silica, alumina, and sometimes also with oxide of manganese and oxide of iron. The object, then, of this Invention is to facilitate the combination of the lime with those oxides by means of agents not hitherto employed. Thus in operating by the dry method, as is generally the case, instead of calcining the limestone or lime with sand and clay, the Inventor, in order to facilitate the combination of the silica and alumina with the lime, introduces a small quantity of potash or soda in the state of carbonate, sulphate, or chloride, or of any other salt of these bases susceptible of decomposition, or becoming a silicate when such calcination takes place. The salt of potash or soda, the quantity of which varies from three to six per cent. to the quantity of lime, is employed in the state of solution so as to penetrate and mix better with the alkaline salt in the chalk or slaked lime; calcination effects the rest in the ordinary manner. In order to combine or incorporate more equally by the dry method the alumina and the oxides of manganese and of iron with the lime, the sulphates of these bases are first decomposed by the slaked lime, by making a paste with a solution of the sulphates mixed with the lime. This paste into which the sulphates in question enter in the proportion of from six to ten per cent. of the lime, is then calcined in order to produce an hydraulic lime. All sorts of lime are made hydraulic by the humid method, by mixing slack lime with solutions of alum or sulphates of alumina; but the best method consists in employing a solution of the silicates of potash or of soda called liquor of flints, or soluble glass. An hydraulic cement may also be made which will serve for the manufacture of architectural ornaments by making a paste of pulverized chalk and a solution of the silicate of potash or of soda. In working with this plaster it becomes much harder than ordinary plaster. These same silicates of potash or of soda dissolved in water will also harden chalk, or soft or porous stones, and transform them artificially into hard stones. In order to do this, these soft stones, either rough or cut into their proper forms, must be soaked in a solution of the silicate, either warm or cold, and allowed to remain there a longer or shorter time, according to the degree of hardness which it may be necessary to give them, after which they must be taken out and left exposed to the air. At the end of a few days stones thus prepared will have acquired a hardness equal to that of marble, and this quality in a little time pervades the whole mass; for if for the purpose of polishing the outer coat or surface is removed, the inner one, which at first is not so hard, will harden in its turn by exposure to the air. This takes place as far as the silicate has been able to penetrate. A more superficial hardness is obtained by applying the solution of the silicate of potash or soda by means of a brush. It is in this manner that walls constructed of chalk and mortar may be hardened. Sculpture and various other objects, which may be made or prepared in chalk, may be hardened, and afterwards serve for decorating buildings and other purposes without fear of their becoming injured by frost or damp. Chalk hardened in this manner may also be used as a substitute for the stones now employed by lithographers. Plaster models may also be hardened by placing them for some time in a solution of the silicate, but it would be still better to add a portion of the solution to the paste at the time of making the model or using the plaster. The silicate of potash or soda is prepared by fusing one part of white silicious matter with from one and a half to two parts of potash or soda in the ordinary reverberatory furnaces or in a glass-maker's or iron crucible. The solutions may be used of any density for plaster, but they should be weaker for chalk. In the last place the Inventor has found that the silicates of potash or soda when dissolved in water, decompose spontaneously in the air and cover the objects to which their solution has been applied with a strong covering or layer, therefore, in applying the solution of silicate of potash or of soda to polished iron, and allowing it to dry in the air, the metal is preserved from oxidation. By soaking wood many times in this same solution, and allowing it to dry in the open air every time after it has been placed therein, it becomes so much penetrated with silica that it acquires a considerable density and degree of indestructibility. The solution of the silicate of potash is not the only substance which, by being injected into porous bodies, tends to harden them. A mixture made from a solution of bi-carbonate of ammonia and of chloride of magnesium may be successfully employed, or a mixture of the solutions of ammonia and chloride of calcium may be used. In these latter cases, instead of having silicious injections, they are either magnesian or calcareous. Soft and porous stones may also be considerably hardened and defended from the action of damp by first well drying them and then dipping or steeping them in sulphur, or some natural or artificial resinous or bituminous substance rendered liquid by heat.

RANSOME'S SPECIFICATION.—No. 6. A.D. 1856. No. 2267.

Specification in pursuance of the conditions of the Letters Patent, filed by the said Frederick Ransome in the Great Seal Patent Office on the 26th March, 1857.

This Invention is applicable, first, to those descriptions of artificial stone which are compounded with sand, clay, and other mineral or earthy substances, together with soluble silica or a soluble silicate; and the Invention consists in adding to the composition of such artificial stone a substance which will fuse more readily than the sand, and will run into and fill the pores of the stone, and thus render it more dense than when compounded without such addition. The substances which I prefer to employ for this purpose are pumice stone, or a readily fusible glass. When I employ pumice stone I prefer to prepare it in the following manner:—I take finely powdered pumice stone and mix it with a solution of soluble silica sp. gr. (1·700) so as to form a stiff paste capable of being moulded, and I mould it into balls of about one inch diameter and fuse it in an ordinary crucible. When fused I grind it into powder and again mix it with a solution of silica, so as again to form a paste; and in preparing the artificial stone I prefer to mix the ingredients in the following proportions by measure:—

Siliceous sand	30 parts.
Finely-powdered silica	10 parts.
Solution of silica, or what is called silicious cement in the Specification of a Patent granted to me, and dated 22nd October, 1844	5 parts sp. gr. 1·700.
Powdered pipe clay	5 parts.
Pumice stone prepared in the way above described	5 to 10 parts.

These materials I mix together and treat in the way described in the Specification above referred to, and which is now well understood. When I employ a readily fusible glass in the manufacture of artificial stone I prepare the glass by fusing together in a reverberatory furnace or crucible the following materials:—

Silicate of soda	100 parts sp. gr. 1·400.
Oxide of lead	100 parts.

And in preparing artificial stone I substitute for the 5 to 10 parts of prepared pumice stone in the mixture before mentioned 5 to 10 parts of this fusible glass.

This invention also consists of a method of rendering artificial or natural stone, bricks, and other materials used for building purposes less liable to decay. For this purpose the stone or other material is coated or saturated wholly or superficially with a solution of soluble silicate, and has afterwards applied to it a solution of chloride of calcium, by which an insoluble silicate of lime is formed in the body of the stone or other material. In place of a soluble silicate and chloride of calcium other preparations may be used; my invention consisting in the application in succession of two solutions, which by mutual decomposition produce an insoluble substance, which is deposited in the structure, and on to the surface of the stone or other material. When I employ a soluble silicate I take a solution of silicate of soda or potash (the sp. gr. of which must depend upon the texture of the stone to be operated upon, but generally about the sp. gr. of 1·400 at ordinary temperatures), and after having removed from the stone, &c. as much extraneous matter as is convenient I apply the solution over the surface of the stone or other material with a brush or otherwise until it has absorbed a sufficiency. I then immediately, or as soon after as convenient, in a similar manner apply a solution of chloride of calcium, taking care to incorporate the two solutions as much as possible by means of a brush or otherwise. By this application the silica combines with the lime, forming silicate of lime in the pores and on the surface of the stone or other material, whilst the chlorine, combining with the soda or potash forming chloride of sodium or potassium, is readily removed by washing. When the stone or other material is of a very porous nature, the strength of the silicate solution may be increased, and one coating will be sufficient; but, if on the other hand the stone or other material is very slightly porous, then the strength of the silicate solution should be reduced, and several coats should be laid on. Or, for some descriptions of stone, more particularly sandstones or freestones, I prefer to use a saturated solution of sulphate of alumina instead of the silicate of soda or potash, followed by a solution of baryta, by which means a compound precipitate of alumina and baryta is produced. Where convenient, instead of applying the solutions by means of a brush, the stone or other material may be immersed in the several solutions. When desired, the precipitates can be coloured to any tint to suit the stone or other material by means of soluble salts of chrome or iron mixed with the solutions employed.

I would remark, in reference to this part of my Invention, that I am aware that wood has before been treated by two solutions mutually decomposing each other; I do not, therefore, claim the process as applied to wood, but only as applied to artificial and natural stone, bricks, and other materials used for building purposes. In some descriptions of stone and other building materials there is contained a free sulphate or carbonate of soda or other soluble salt which is liable to effloresce; to prevent this, and partially to indurate the stone or other substance, I employ a solution of barium or calcium, using a concentrated solution of the chloride of barium or calcium by preference.

DISCUSSION ON THE PRESERVATION OF STONE—CONTINUED.

February 4th, 1861.

Mr. M. DIGBY WYATT, Vice-President, in the Chair.

Mr. LEWIS, Hon. Sec. read Letters from M. Szerelmey, Mr. A. Ashpitel, and Mr. J. J. Cole, of which the following are extracts:

New House of Parliament, Westminster. London, February 2nd, 1861.

To the Members of the Institute of British Architects.

" GENTLEMEN,

" Although long resident in this country, I am still a foreigner, and but imperfectly acquainted with the English language, and am therefore diffident of venturing upon a personal explanation, I therefore trust to your indulgence in the following brief disquisition communicated through your Secretary.

" I fully agree with the opening speech of the talented member, Mr. Tite, M.P., as regards his remarks on the term *zopissa*, a word applied by the Greeks to a certain process for preserving the timber of vessels, but I respectfully conceive that he has not gone far enough; the processes of both zopissa and encaustic, although ever tending to produce the same result, were of a very varied and undefined nature, artists modifying them according to their judgment, or as might be considered expedient for the occasion. The only zopissa spoken of is that for ships; no mention is made of the secret processes used by the great masters, nor is it ever stated that zopissa and encaustic were confined to fixing colours and indurating wood. As the term is used by me, it has a far more comprehensive signification, implying a preservative compound, without reference to its being applicable to wood or stone, but embracing both. It includes the processes employed by the earlier Egyptians in preparing the groundwork for their monumental inscriptions, the mixing and fixing of their colours and their preservation, the preservation of the sycamore and other woods of which their coffins were composed, the solidification of their cements, the groundwork of their simply concrete or cohesive masses. I have not stated, either publicly or privately, that I used the process described by Pliny; but, on the contrary, have given it to be distinctly understood that my composition varied with the nature of the work. What these processes are, for the present remains a secret, the only mode left me as a foreigner of reaping the fruits of my previous toil and application to acquire it.*

" Mr. Burnell tells you, gentlemen, distinctly, that the Speaker's court is a failure—that the plaster or cement is rapidly falling off—and that my process is a failure. Had Mr. Burnell made a close examination, he would have made the discovery that there is *no* plaster or cement to fall off; the material I use is absorbed within the stone, and till its exterior is supersaturated, the surplus may in some instances lay on the surface, presenting a kind of raised appearance; but this very fact is an advantage rather than a fault, since it demonstrates that the work is well finished, and the stone hermetically sealed. Still in no one instance can it be proved that this surface could be scraped off. It is true that several purported analysis have been published, but I can with veracity and confidently state that not one of them advances beyond guess-work as to the nature of the material used by me. In all the courts operated upon by me the stone is very much harder than it was before, and that which was done upwards of four years ago, has become exceedingly hard. In no part can the material used be scraped off without bringing with it the surface material of the

* It is scarcely necessary to mention that M. Szerelmey has been quite misinformed as to this.

stone itself. But, say my adversaries, you use, according to your own account, zopissa, and taking the term in the sense explained by Pliny, you use pitchy and bituminous substances, which must cause the stone to turn black, or rapidly decomposing throw it open once more to the destroying influences. The stone of this magnificent pile of buildings is, as you all know, extremely varied in its nature, and on some of the blocks or slopes the dirt of the bed, from whence they were taken, or the deposits of impurities with which the atmosphere of London is ever loaded, have so encrusted the surface as not to be removed otherwise than by the chisel. Again, let it be recollected that the process covers in the decayed surface, and though by this means further decomposition is arrested, the scar and the seam still remain, and may be seen, there being neither plaster nor cement to conceal its defects. Again, the stone presents every variety of shade, and much of it, if freely exposed to the atmosphere, would soon become black and unsightly. The eye of the practical architect may condemn all change from the original colour of the stone, but the evil cannot be remedied otherwise, and the uniformity and general effect obtained by my process met with general approval, I can safely aver, from the late Sir Charles Barry.

" It is against the evidence of innumerable facts, furnished by nature, to assert that bituminous substances have no preserving virtues, and quickly perish, or that as co-operative agents they are incapable of entering into permanent combinations. The earth's exterior beds in all parts of the earth are replete with bituminous animal and vegetable exuviæ, with fossil oils, gums, resins and other fatty or oily earths existing in most countries, and under numberless combinations, existing age upon age, and impervious to all external influences except by fire; a slight chemical change in their atomic parts causes them to enter into the fossil kingdom and become bodies of another nature, capable of resisting further change and elemental influences; hence the many beautiful specimens of fossil gums, resins, honey and oils, containing insectivora, and which are preserved for ages without change or decomposition by the immersion in a bituminous menstruum. Wax, pitch, and other bituminous products are in themselves in the highest degree preservative, and judiciously and skilfully united with other bodies, enable them to bid defiance to time and the destroying elements, conferring durability on timber, forming japans, lacquers, and varnishes, that, in their united state, are, so far as mere external influences are concerned, comparatively undestructible.

" It has been publicly asserted by chemists, who are assumed to be authorities in these matters, that the use of organic substances for the preservation of stone is to be deprecated as inoperative and inefficient. I beg leave most respectfully to differ from these recorded opinions. In the modus operandi of nature for the formation of rock from calcareous matters in which a great quantity of bituminous matter is uniformly blended, the object attained is by decomposition, the formation of an acid that will constitute the general basis, and a recombination of the comminuted bodies according to the laws of affinity and cohesion: in this action and reaction the bituminous matters pass by transition into other forms and combinations: thus they may be lost to analysis, but their elements have gone towards incorporating and strengthening the whole. The act of decomposition changes the nature of the individual bodies, producing acids and alkalies; the act of recombination unites them into neutral compounds. As it is in nature, so is it in art; you cannot decompose the stone without changing its condition in recombining its atomic parts; but when you know that the cementing basis is weak and imperfect, and wholly incapable of resisting exterior destroying influences, you may, the stone being of an absorbent nature, add such material as may permeate its exterior surface to the required extent, as by affinity and force of cohesion will unite with the atomic parts without effecting chemical change, filling in the pores, and so hermetically sealing it from all external destroying influences.

" Much has been said concerning the preservative and indurating properties of silicated water; there is no question that, were the knowledge acquired of restoring by synthesis the silica to its original state of flint-like hardness, it would be of vast utility for indurating substances; but chemists have not arrived at that knowledge. What is termed liquid glass (a discovery bye the bye no ways new) is silicate of lime, potash, or soda: otherwise speaking, a menstruum in which the two earths are held in mechanical solution, and not a homogeneous elastic compound, the silica being present to the extent of about 15 per cent.: from this solution the metalloyd is readily precipitated, the silicate, when the water is evaporated, being left in the form of a dry white powder. Chemists have erroneously supposed that the stone would absorb this mechanical compound, but the stone acts as a filter, it receives within itself the water, and the two earths are left upon the surface, without power of further action, either chemical or mechanical, and with only a slight cohering force wholly inefficient to produce the result contemplated.

" I have already used my process over thousands of square yards of the Palace exterior without altering the natural colour of the stone, but stopping only the blackening process. In all I have done I have arrested the progress of decay, and rendered the stone harder and more durable, and the short time that has elapsed, about four years and a half, is sufficient to satisfy any disinterested or talented person, that time only adds to its hardness.

" I have only to add that I shall be proud and happy to see a Committee appointed to investigate and report upon what has already been done, provided the Members are chosen for their scientific and practical knowledge, and come to their work unprejudiced, and uninfluenced by personal considerations. Insulated in my position from the fact of being a foreigner, and since the death of Sir Charles Barry, deprived of that auxiliary assistance and influence which never failed me in the trying hour, not sufficiently conversant with the English language to convey with force, truthfulness and judgment, my thoughts and feelings, my only hope is to see these charges duly and righteously investigated.

" I beg to subscribe myself respectfully yours,

" R. C. Szerelmey."

" 2, Poet's Corner, Westminster, February 4th, 1861.

" My dear Sir,

" Having taken so great an interest in the different processes for the induration of stone, and having had such opportunities of inspecting the progress of the various operations which have been carried on close by, I extremely regret that I cannot be present to night.

" I should have wished to have offered a few words on the salient points that arose the other night, and which may also arise from the printed papers now before me, and I hope the meeting will not object to listen to a few of my short notes thereon.

" First, as to the zopissa, which it has been asserted has been mentioned both by Pliny and Vitruvius in connexion with encaustic painting. I find no such mention. Pliny * describes it in the words cited by Mr. Tite, as the scrapings of ships' bottoms, composed of pitch and wax, which had been softened or purified by the action of sea-water, and in another passage he says zopissa is useful

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* The two passages in Pliny run thus:—Lib. xvi, c. 23. Non omittendum, apud eosdem zopissam vocari derasam navibus maritimis picem cum cera, nihil non experiente vita, multo efficariorem ad omnia quibus pices resinæque prosunt, videlicit adjecto salis callo.

Lib. xxiv, 26. Zopissam eradi navibus diximus cera marino sale macerata. Optima hœc a tirocinio navium. Additur antem in malagmata ad discutiendas collectiones.

as a species of poultice (malagmata) to disperse gatherings. The same definition is given in Dioscorides,* and the same one in the original work of Paulus Ægineta. Vitruvius, on whose authority so much stress has been laid, never even mentions the word. I cannot conceive that a respectable man would willingly attempt to impose on the Institute by false quotation, and, therefore, fancy Mr. Szerelmey has confused the zopissa with punic wax,† which last material was the vehicle of encaustic painting. This was wax purified by boiling it with sea-water, or with nitre. The zopissa may be said to have been purified by sea-water, but to suppose that pitch‡ was ever a vehicle for laying on delicate colours is quite absurd. Fancy painting such delicate figures as those at Pompeii out of a pitch pot!

" But I must not go at length into any point. However, as anxious to see even-handed justice done to all parties, I beg to say a few words on Mr. Daines' patent. He seems doomed to be misrepresented, or, at least, mistaken, on very many points. He does not boil the oil and sulphur. The former will not boil at less than 600 deg. Fahr., and then becomes a dirty, viscid body. He assured myself, Mr. Sydney Smirke, and Mr. G. Gilbert Scott, that the oil is only heated sufficiently to take up as much sulphur as it will, which is known by the crystallization of the superfluous sulphur. The specimens of the material exhibited to us as used by him were certainly not darker in colour than common oil. This composition does not dirty the stone. This may be seen at once by examining the bay in Old Palace-yard, close to the Victoria Tower, and to the north of it. The discoloration of the first attempts is clearly explained as an accident. It is said Mr. Daines' solution does not penetrate the stone. This we can satisfactorily disprove, as, by Mr. Scott's suggestion, we broke the specimens in half, and found the material had penetrated the stone as stated in our report, which I enclose.§ We also found that the part operated on was harder than that untouched, that it was more repellent of water, and in general of cleaner colour. Of course, we could not pronounce on the validity of the specimens, but we had a letter from a respectable solicitor stating they had lain for five or six years in his garden under the drip of the coping of a wall. It has also been asserted that his solution immediately or very shortly leaves the stone. This we can safely disprove, as, by placing the pieces on hot iron, a vapour arose of the strongest smell, and which did not get out of the house for many hours. This vapour also discoloured silver, so that we felt convinced at the time we made our experiments that not only the oil but the sulphur was present in the specimens.

" I may say for myself, and I think for my coadjutors, that we were pleased with the simple, though earnest way in which Mr. Daines stated his pretensions. He said he did not pretend to the transmutation of stone, nor did he say he changes chalk into granite. But this he claims to do: every one knows that oil is in itself one of the best preservatives of stone, but the heat of the sun, and the changes of the atmosphere, soon dry out its particles. He combines it, therefore, with the hardest and most durable material he knows of which will combine with it; and which, while at the same time it adds to their durability, purifies oils, and all similar matters, from vegetable mucus, and

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* Dioscorides, lib. I, c. 99. *Ζώπισσαν δὲ ὁι μὲν ἔιπον τὴν ἐκ τῶν πλυΐων ξυομένην ῥητίνην μετὰ τοῦ κηροῦ, καλουμένην ὑπ ενίων απόχυμα, ὁι δὲ τὴν πιτυίνην ῥητίνην.*

The fact is, the pitch was considerably purified by constantly passing through the salt water, and was then used as a plaster much as what we call Burgundy pitch is with us.

† The method of preparing punic wax is described at length in Pliny, lib. XXI, c. 14, and by Dioscorides, lib. II, c. 75. The method of using it in painting is given by Vitruvius, lib. VII, c. 9. The boiling the wax in salt water with a little nitre not only freed it from vegetable impurities, and fatty acids, but whitened it so as to fit it to be mixed with colours.

‡ *πισσα*, pitch from the pine tree, not bitumen, *ασφαλτος*.

§ Vide page 186.

all uncombined fatty acids. In this sense he seems to have quite as much title to talk of zopissa and encaustic as anyone else.

" Now, Mr. Daines, as we understand him, adds, 'I do not pretend to transmute stone, but I cause it to imbibe such a material that its surface will repel the weather and prevent decay (quite as well as paint or ordinary oil will), not only for three years, our usual renewal of outside coating, but for twenty-five or thirty years, and yet the grain and colour of the stone shall be uninjured. By this time the stone will become naturally hardened or weathered.' If not, it will be a cheap process to repeat it again at the close of a quarter of a century, and the stone may then, at fifty or sixty years, be supposed to be safe.

" What results may happen fifty or even much fewer years hence we cannot foretell. Indeed, this investigation reminds us of the pedant in Hierocles, who was told a raven would live a thousand years. He replied, he did not believe it, but he would buy a young one and try. This remark applies to the future of all these processes; but we have before us a present need. A noble building is fast going to decay, and we must not loiter in our attempts to arrest its ruin. Among the processes before us I must say I think that of Mr. Daines' is entitled to notice. It is novel, simple, intelligible, and does not profess too much.

" In justice to Mr. Ransome it should be said that I have this morning witnessed some experiments which (though no profound chemist) lead me to believe that his solution does penetrate the body of the stone, which has been denied, and that the product of the double combination which takes place is insoluble in water. His process, however, requires great nicety in manipulation. Too much of either of his solutions does mischief; but as practice makes perfect, he claims greater certainty and better results every day, though his theory is based on the same principles as in the beginning.

" In conclusion, I would strongly recommend the formation of a Committee, as proposed, with power to consult the best chemists, and our brethren in constructive science, the Institute of Civil Engineers, and should be proud to assist in any way my present stock of information would afford.

" Believe me, very truly yours,

"T. Hayter Lewis, Esq." Arthur Ashpitel."

" 24, Essex Street, Strand, 4th February, 1861.

Dear Sir,

" If Mr. Ferrey should happen to be present this evening, he might be asked whether he has continued to use the preservation soap and alum process of Mr. Sylvester which he introduced to the Institute some years ago, and with what result. For, although it might not satisfy the ultimate requirements of such a building as the Houses of Parliament, yet from its cheapness and simplicity of application, it might be worth while to employ it to arrest the decay of some parts, at least, during the years of inquiry and experiment which obviously will elapse before the best and only thing shall be determined on. Mr. Burnell, or any other good chemist, would say whether it could interfere with a silicate applied hereafter. I think not. For the protection of stone from the effects of the first twelve winters after working and setting, Mr. Sylvester's process is certainly an excellent one according to my own experience. I lately examined a church of old and new red sandstone done with it ten years ago, and I searched in vain for the slightest decay of an arris or even in the ashlar of the plinth, in which parts the stone in other buildings in the neighbourhood always perishes. The oolites, even in London, are preserved by it from that miserable black discoloration

(not an artistic time-honoured tint), which frost and rain bring with them. It is, as you may remember, easily made and used by any ordinary workman, and £12. average for a church is not dear for immediate benefit. But Mr. Ferrey's renewed approval would do more good than mine.

Yours, truly,

"T. Hayter Lewis, Esq." "John J. Cole."

Mr. Tite, President, read a letter from Mr. Grissell, which is as follows:—

"Norbury Park, 31st January, 1861.

"My dear Sir,

"I am much interested, as you are aware, in the durability of the stone of the New Houses of Parliament, and were it not from indisposition which confines me to the house, I would personally attend the next ordinary meeting of the Institute of Architects, in order to afford any information or explanation in my power touching the interesting subject under discussion, or with respect to the extent of care and experience in the selection of stone in the working of the quarries. I can only say that, had we to go through the quarrying operations again, the workmen employed, who it must be remarked were only practical masons and quarrymen, could not with their amount of intelligence, have exercised greater care and discernment in the selection of the stone; and the greatest care was taken not to send any soft or unsound stone to London.

"The object, however, mainly of my addressing you, is to correct a misapprehension as to the apparent difference in the selection of the stone for the new Houses of Parliament, and that supplied for the erection of the Museum of Geology in Jermyn Street, in reference to which you say that "in one case the selection was good, while in the other it was bad." In reply to which I beg to assure you that the stone for both buildings came from the same quarry, and was got by the same workmen without reference to any special selection or for any particular building, so that it is entirely a matter of chance as far as the selection is concerned—the situation of the two buildings not being identical may have something to do with the increased stability of one over the other. Of course in the same quarry there are some portions of the rock more dry and of closer texture than other portions, and, to use a technical term, more crystalline in its nature, but at that time we were not informed that to ensure perfect durability, it was necessary that the stone should be perfectly crystallized.

"The truth however is, that the stone first selected by the Commissioners was a similar stone to that used—a magnesian limestone—but was found on the estate of Lord Bathurst at Bolsover Moor, about six or seven miles from the village of North Anston, where the quarries are situated, from which the stone was ultimately supplied; but it was found on opening the quarry at Bolsover, that the stone could not be obtained in sufficient thicknesses or sizes for the purpose required. The Commissioners had therefore to select another spot in the same neighbourhood, where the quantity and sizes could be obtained, and this was found at North Anston on the estate of the Duke of Leeds —the stone appearing to be of the same nature and quality as that first selected, with the exception that the Bolsover stone was of somewhat finer grain and closer texture, but in all other respects was identical.

In conclusion, permit me to say that I think nothing would have prevented the present dilemma in which we are placed, but the appointment of a resident *chemical* agent in the quarries at the commencement of the operations, and, possessed of our present information on the subject, to have determined which portions of the rock were perfectly crystalline from that which was not so.

W. Tite, Esq., M.P., F.R.S. "T. Grissell."

Mr. Tite then stated that, in reference to the above, he referred to the fact elicited at the last meeting, that the Bolsover stone, first recommended by the Commissioners for use in the Houses of Parliament, had been given up as not being found in blocks of sufficient size, and another stone substituted for it. There was a great difference between the quality of different beds in the same quarry. Thus the upper beds of the oolite of Portland were unsafe for use, whereas the lower beds were good and perfectly safe.* The same was the case with the Bath stone, the lower beds being of very fine quality and well calculated to resist the atmosphere. The Caen stone used by the Normans had stood well, as was shown by many existing buildings, but the modern Caen stone universally failed. This was from the lower beds however; the old stone being from the upper beds. He believed this was rather a question of dip. After stating that he thought Mr. Ransome's process would lead to a solution of this most difficult question, Mr. Tite repeated his chemical experiments. M. Szerelmey appeared to suggest that there had been a sort of attack upon him. Certainly he had made no attack whatever himself; he had only suggested that as a foreigner that gentleman was deserving of every sympathy; that his natural feeling as a foreigner probably made him unwilling to divulge his secret, but that it would be difficult to keep it in these days of chemical research; and further, that if his invention was worth using he ought to be paid for it. Unless there were two gentlemen of the name however, M. Szerelmey had already, in 1857, obtained a patent under our laws for the preservation of stone; but he (Mr. Tite) could not conceive how he could use those materials in 1861 with any chance of success. With regard to Mr. Daines's process he did not see how the oil was destroyed by boiling sulphur in it; the result in fact was only a dirty sticky mixture. Mr. Warington would explain how he proposed to get over the objection already mentioned to Mr. Ransome's process, and as his object was to bring out as many practical points as possible in the course of this discussion, he should be glad if any gentleman would say what processes he had tried, where they had failed, and where they had succeeded.

Mr. Warington, Visitor, said that, for some time past, he had given much attention to this subject, having been requested by Mr. Ransome to examine chemically various specimens obtained from the exterior of the new Houses of Parliament. The surface of the stones, which were in a state of disintegration, was covered with a dry powder in considerable quantities, consisting of sulphate of magnesia with a large proportion of the substance of the stone—the latter varying from 30 to 90 per cent. This, he considered, arose from the action of the products from our coal fires—sulphuric acid and ammonia—with which the London atmosphere is much charged, condensing on the surface of the building and washed by the first shower into the absorbent porous stone. This saline matter, acting on the magnesian limestone, causes the formation of sulphate of magnesia, sulphate of lime and carbonate of ammonia. The sulphate of magnesia, being a soluble and crystallizable salt, soon appears as an efflorescence on the surface, and as it crystallizes out, disintegrates the whole exterior of the stone, where the aggregation of the particles is not sufficient to resist this rupturing force. One bay of the Houses of Parliament had been operated on with the silicate of soda and chloride of calcium since 1855, and there the efflorescence had exuded without in the slightest degree disintegrating the surface. By sweeping off this efflorescence he found it to contain 95 per cent. of sulphate of magnesia, without a particle of magnesian limestone. If the exudation from the face of the stone be prevented by the application of a material, as paint, that would impede the natural efflorescence of the contained saline matter, it would, after a time, force its way out, causing the exfoliation both of the stone and also of the facing; at first in small and then in large patches. [Mr. Warington referred to Mr. Tite's experiments, and entered into the chemical details of the

* Vide page 163 (Mr. G. G. Scott).

question.] In reply to the Chairman he stated that there was a perfect contact and a crystalline adhesion between the silicate of lime and the particles of magnesian limestone. If silicate of soda and muriate of ammonia were employed there might be a silica cement instead of silicate of lime, but it was a matter for experience to decide which was the best.

Mr. C. H. Smith, Hon. Member, wished to say a few words with reference to the origin of the question, as it concerned the Houses of Parliament. In the first place he begged to say that Mr. Grissell, Sir S. M. (then Mr.) Peto, and Mr. Jay did everything in their power to forward the views of the architect.

The Chairman called Mr. Smith's attention to the statement of Mr. Grissell that after it had been found that the Bolsover Quarry, originally recommended, would not yield blocks of sufficient size, the Commissioners had to select another quarry in the neighbourhood. Did the Commissioners do so?

Mr. Smith said they did. But although it was generally understood that they recommended "Bolsover stone," they were very cautious in their recommendation, and the words they used were that it should be stone "similar to that of Bolsover Moor and its neighbourhood," the intention being that they should have a range all round the neighbourhood. It would be remembered that one of the earliest works of Sir C. Barry was St. Peter's Church at Brighton, which was built of Portland stone, and was one of the worst specimens of that material. When his design was selected for the Houses of Parliament, the question arose as to what stone should be chosen as most suitable, or likely to be more durable than that with which his church at Brighton had been built; the Commission was appointed, of which he (Mr. Smith) was the only representative living. They assembled at Newcastle-upon-Tyne, where the British Association then had its meeting, and there, under the advice of Sir Henry de la Beche and Sir Charles Barry, the subject was brought before that body. A plan was formed by Dr. Buckland, afterwards Dean of Westminster, and others, and was put in practice according to their advice. The stone actually used was that known as Anston, he (Mr. Smith) having found out the quarry himself. In the first place, after the contractors were chosen, Sir C. Barry, Sir S. M. Peto, Mr. Grissell, and himself, went round the neighbourhood to examine the quarries, and after they had ordered holes to be dug in the environs of Bolsover Moor, to search for the best stone, it was found that Bolsover stone, though good of its kind, was too small to be worked profitably by the contractors; and after ordering other holes to be opened they returned to town. A few weeks afterwards he (Mr. Smith) was sent down by the Board of Works to examine these holes; and, before going, he proposed to Lord Duncannon, the Chief Commissioner, that he might be allowed, in case the stone in those holes should prove unfit for the purpose, to drive round the neighbourhood and examine further. This was agreed to, and during that visit he noticed on the map the name of "Anston," which led him to conjecture there might be stone in that district. On enquiry he was informed that there were plenty of stones there "as big as great hayricks," and there accordingly he found the stone which was used for the Houses of Parliament. It was generally supposed that a great deal of the earlier part of the edifice was built of the Bolsover stone, and particularly the basement of the river front. The latter, however, to the height of about six feet was built of stone from the Stonend Quarry, about a mile from North Anston, which was used because it was thought harder and more durable for the part near the ground. In fact there were not ten tons altogether of Bolsover stone in the building. The result was that, with the consent of the contractors, it was agreed that the stone should come from Anston.

The Chairman inquired whether the Anston stone received the sanction of the Commissioners as a body. In the first place they gave a general recommendation of the stone from Bolsover and its neighbourhood; then there was the circumstance of Mr. Smith going down and lighting upon the

Anston stone. But he wished to know whether the Commissioners as a body recommended and approved of the use of the Anston; or, in other words, on whose responsibility the substitution of Anston for Bolsover rested.

Mr. Smith explained that he ordered a fair average block to be prepared about 18 inches by 9 inches square. It was sent up to London, and after it had been worked into particular specimens, it was submitted to Sir C. Barry and Sir H. de la Beche (Dr. Smith, the only other Commissioner, lived at Scarborough) and they approved of it, and considered it equal to the Bolsover stone. It was not quite so hard but was equally crystalline.*

The Chairman said that this statement settled the question of divided responsibility, which it was always desirable to obtain.

Mr. Smith said there was at Anston some of the worst stone in the world. Some of this had been used in London, and the stone of the new buildings of Lincoln's Inn was somewhat of this description; the same might be said of the large Railway Hotel at Hull, which was said to be of the same stone. On the other hand, there were many good specimens, among which were the Geological Museum in Jermyn Street, with a front in Piccadilly, and the elevation of the Amicable Assurance Office in Fleet Street, where there was but a small amount of decay. The stone for the Jermyn Street Museum was selected by Sir H. de la Beche and himself, Sir Henry being most anxious, as President of the Geological Society, not to have any bad stone in the building.

Mr. Tite.—In fact that stone was picked?

The Chairman assumed from the fact of their exercising this extraordinary vigilance, that if they had taken the stone promiscuously, it might not have been trusted to. Did they entertain such a doubt?

Mr. Smith said they did. Sir Henry de la Beche and himself went down to the quarries for the purpose of choosing the bed from which the stone should be used. He was extremely anxious and cautious that there should be good stone.

The Chairman.—Was a similar degree of vigilance used for the Houses of Parliament?

Mr. Smith.—Certainly not. A great deal of Portland stone was bad, and he might state that he went with Sir C. Barry to look at the river front of Somerset House, the upper part of which was in as bad a state as possible. The lowermost portion however was good, and a perfect line could be traced where the stone above began to get bad. A gentleman had said at the last meeting that the stone of the Houses of Parliament was amorphous instead of crystalline, meaning that it was not well crystallized, which was the fact. The grains were not well cemented together, which was the great secret of the whole evil. The stone of the Palace of Westminster was not selected, but taken collectively, without discrimination or selection of any sort. There was some talk of appointing a person to select the stone, and that course was recommended by Sir C. Barry and Sir H. de la Beche. At that time he (Mr. Smith) had the reputation of knowing something about stone, as was shown by his having been appointed as one of the Travelling Commissioners without previously having heard of such an undertaking, and of course he was very much pleased to act, especially in such good company. When it was recommended that some person should be appointed to select the stone, he was named as a fit and proper person for that duty. His appointment was recommended by Sir C. Barry and Sir H. de la Beche, approved by the then Chief Commissioner, Lord Duncannon, and everything was settled, even to the salary which he was to receive. It was thought that he might have to visit the building two or three times a week; sometimes to stop only five minutes, and at

* Vide page 171 (Mr. E. M. Barry).

other times perhaps nearly all day. The parties talked of £150. a year, and he (Mr. Smith) accepted it. But then another point arose, namely, who was to pay him?—the builders, the architect, or the Government?—and he never could get them to settle who was to pay him. All he could say was, that as soon as they had settled that important point he would commence work, but the reply was, "Oh, you will be sure to be paid, and there will be a principal and an assistant;" but upon inquiry he found from some hints that were dropped that he was to be the assistant. He then enquired who was to be the principal, and told them that before they calculated upon his services they must settle who was to be the principal; because it might be some one he might object to work with. However that was never settled; he never began to work, he never was appointed, nor was anybody else; and that was, most probably, the great secret of all the failure. When the contract with Messrs. Grissell and Peto was discontinued and Mr. Jay took it, for executing the part in Old Palace Yard, it was recommended that he (Mr. Smith) should visit the quarries to see if the stone was being worked properly. This he (Mr. Smith) did accordingly.

The CHAIRMAN asked Mr. Smith what was the nature of his report at that time?

MR. SMITH said he reported that the stone was quarried well and well worked, but that a great deal of it was defective.* Some gentleman had said that the sulphuric acid in the atmosphere of London was destructive to stone. No one knowing anything of chemistry could deny this, but it was equally certain that every grain of sand thrown into the sea would raise the level of the ocean: the London atmosphere was not the principal cause of decay. There was plenty of good stone in London, equally exposed to sulphuric acid with that which had decayed. When he met Mr. Jay at the quarries he (Mr. Smith) was anxious to find out where the stone had been taken from for the buildings in Lincoln's Inn. The quarryman immediately took him to the place, and he found on drawing his finger along the stone he left an impression on it. The evil was not, therefore, in the sulphuric acid of the London atmosphere, but in the stone not being well cemented together; the former having, indeed, very little to do with the matter. It was the same with Portland. That stone was not necessarily bad because the river front of Somerset House had decayed. On the contrary, in St. Paul's, the Post Office, &c., it had stood very well; the truth being that if a stone was bad it would decay whether in town or country.

The CHAIRMAN inquired whether, at the date of the visit to the quarries last referred to, Mr. Smith had any reason to believe that improper stone had been taken for the Houses of Parliament?

MR. SMITH said he had; there was no doubt about it, but he was not called upon to make a report upon that.

The CHAIRMAN asked what his specific mission was at that time?

MR. SMITH stated that his warrant from the Office of Works, which was still in his possession, gave him authority for what he was to do. Before he went he asked Sir C. Barry what he had to

* "29, Clifton Street, 10th April, 1853.—Dear Sir,—In compliance with your instructions, I visited, on the 8th and 9th of last February, the quarries at North Anston, from which the stone for the exterior of the New Palace at Westminster is now being obtained by Mr. Jay, the present contractor; and I have to report to you that the stone which he is now quarrying forms part of the same beds of magnesian limestone as those which were worked by the late contractor, Mr. Grissell, in pursuance of the recommendation to that effect in the report of the commission appointed for the purpose of selecting a fit and proper stone for the New Palace in the year 1838. The stone which is now obtained continues to be of the same excellent quality as that which has been hitherto selected for the New Palace at Westminster. Mr. Jay's quarries are contiguous to those of Mr. Grissell: they contain the same number of beds, varying in thickness from 8 to 39 inches, and measuring together a total thickness of 23 feet. Specimen blocks, which I marked both in Mr. Jay's and Mr. Grissell's quarries, have since been forwarded to me in London. I have had those blocks worked into mouldings, &c., under my own inspection, and I cannot, after a careful examination, discover any difference whatever in their fitness for architectural and sculptural purposes, nor can I detect any variation in their chemical properties.—I remain, &c., (Signed) C. H. SMITH."—"To Sir Charles Barry."

do; and the answer was that he was to see whether the quarries were worked well, and whether any other parts of the neighbourhood were likely to produce better stone if wanted.

The CHAIRMAN thought Mr. Smith's report at the period referred to was rather an important matter, because it fixed some one's cognizance of the condition of the stone at that date. It was important, and might become more so.

MR. SMITH was quite certain there was no supervision of any kind either at the quarries or at Westminster,—neither by Messrs. Grissell and Peto nor by Mr. Jay. If there was any supervision at other buildings it was in favour of the contractors; and there were men at the quarries who selected stone for other buildings to suit their masters. Water accelerated decay, and it was most likely to act upon the upper beds of the cornices, &c. In some buildings he had recommended these parts to be covered, and with a good result, and whatever means of preservation should be adopted in the Houses of Parliament, particular care should be given to the exposed upper surfaces to keep out damp.

Mr. G. G. SCOTT, Fellow, said the question before the meeting was not only what could be done to arrest decay, but what kinds of stone should be used. Science, of course, must have its share in the selection of stone, but no rules could be laid down as positive tests of durability, either founded on geology, mineralogy, or the mechanical structure of stone. Even the different kinds of granite were not all durable, as shown in the valleys of Dartmoor, which were covered with its decayed debris. Chemistry and geology would aid the selection, but the experience of what material had stood best in old buildings was the most valuable test. Among the fine hard sandstones of the West Riding of Yorkshire there were perhaps ten stones, more or less perishable, to one good one, and the same might be said of the oolites. No district could be said generally to produce good stone, but only particular stones, which were good; the majority being inferior. Even a particular quarry, though generally good, nearly always produced some bad stone. Every architect should be guided by the wear of building stone in the neighbourhood, and in the case of a new quarry by that of stone approaching as nearly to the untried material as possible. No stone had ever withstood the London atmosphere so well as Portland, but it would be wrong to lay down as a general rule, that Portland stone is trustworthy; the greater part of even Portland stone was bad. This applied to one half of stone in nearly every quarry in the island, and, of the stone sent to London, a very large proportion indeed was bad. It is said that 19 out of 20 among the London masons rejected the good stone if they could, and used the bad in preference, their reason being that the latter was a whiter, prettier, and better looking stone than the superior quality. An architect seeking information from the Portland quarrymen would find, after a few hours examination, that, throughout the island, the bad stone is known by the name of the "best;" so that the term "best Portland" in a specification might lead to a quibble, for the stone known as "best" was really the *worst*. Mr. Tite had made an accidental error in stating that the *lower* bed at Portland was the most durable; it was in fact the *upper* bed. The upper and lower beds had not the same relative merit in different rocks; indeed it appeared to be an accident of nature whether good or bad stone was the first deposited. As regards the beds at Portland, the hardest was at the top and was called the cap: that below was called the *roach*, and was full of shells and extremely durable and valuable for engineering but not for ornamental purposes; the next below called *whit* or *white* (perhaps because it was not white but brown, for they seemed to go there by contraries) was the best for external work, and the really white stone, forming the lowest bed, although called "best," as already stated, was very inferior and not durable. Besides, however, the difference between the beds, the quality of Portland stone varied greatly in different quarries and in different parts of the island. It was difficult to ascertain by mere examination the probable duration

of stone, but he thought science ought to enable chemists and geologists to discover the causes and condititions on which durability depends in different kinds of stone and to suggest methods of making inferior stones durable, by imitating the operations of nature. If silicication could be so applied, in accordance with natural processes, good results might probably be expected. If it is not found that the most durable limestones contain a considerable quantity of silex, he would suggest that it becomes questionable whether the addition of silex is the most suitable method of rendering softer limestones durable. Sandstone, on the contrary, was in its nature silicious, and required a silicious cement; but stones cemented calcareously by nature would, as it would appear on a *primâ facie* view, rather require a calcareous cement. Both good and bad Portland stone was oolitic, but the good stone was cemented by a crystalline cement, whereas the pores of the bad stone were filled with a powdery substance like chalk. In the same way the cementing properties of magnesian limestone should be traced. He thought the crystals both of the Bolsover and Mansfield Wood House stones, were very distinct, whereas they were not distinct in the inferior beds of the Anston stone, where a powdery substance was visible in their interstices; and this might be one of the reasons why the latter disintegrated while the others stood. If it could be proved that silex or any other mineral could be so introduced as to fill up the pores with a crystalline or vitreous substance, good must result; but Mr. Warington said that the silicate settled in the pores in the form of a powder, and this in the inferior Anston stone would not be doing good, but harm. It may probably be shown that silex, under favourable conditions, may combine with lime, but absolute proof was required that the chemical agents employed assumed a crystalline or vitreous form, or they would be merely useless additions to the stone. In the case of chalk-flints the whole of the chalk had been, during its formation, impregnated with silex, dissolved in some way in water, and which, instead of hardening the substance of the chalk, has since become aggregated into flinty masses scarcely distinguishable from those formed by heat. The chemists may, perhaps, be able to tell us how and by what agency the flint was originally dissolved, and how it coagulated in such masses; but if they could further show how such a substance might now be produced in the pores of stone, there would be some ground for confidence in the results. They could then turn sandstone and limestone into chert, which was one of the hardest and most durable substances known.

The Chairman suggested that Mr. Ransome's silicious stone was the nearest approximation to chert.

Mr. Scott said that this had been vitrified by means of heat. Confirming Mr. Smith's statement that but a very small quantity of the Bolsover stone was used in the Houses of Parliament; he referred again to the stone from the Mansfield Wood House quarries, of which a considerable quantity was used. These quarries were still in work, and he himself frequently used the stone, which was thoroughly good and durable; and indeed, according to his impression, the only one of the magnesian limestones which could be proved to be trustworthy. It had stood exceedingly well in the Martyr's Memorial at Oxford, a place very destructive to stone. He believed that the use of this stone at Westminster was discontinued, because of some curious holes to which it was subject, and of its not being in very large blocks, the usual sizes being from 18 inches to 2 feet 6 inches in thickness and from 4 to 8 feet long. Mr. Smith appeared to rest very much upon the saving clause in the Commissioner's Report recommending that the stone should be that of Bolsover Moor, "or its neighbourhood," but he was surprised that any scientific body should have introduced such a clause as that. Mr. Smith himself, in a paper printed in the Transactions of the Institute, had referred to the excellence of the stone of which Conisborough Castle was built, but within a very short distance of the Conisborough quarries there was another called Cadely, the stone from which is notorious for its badness, and which he

(Mr. Scott), had used in the interior of a church near there, where it rapidly decayed even after the church was roofed in. The old church at Doncaster was built of stone which might be said to be from the "neighbourhood" of Conisborough, and he (Mr. Scott) having used the old stone for internal ashlar in the new church, found that it decayed in the middle of summer immediately after it was worked, and even before it was put in the wall. These and other cases amply proved that no trust could be placed upon particular "neighbourhoods." (Mr. Scott submitted for inspection two specimens of the Anston stone, taken from beds pointed out to him on the spot by the foreman of the quarry, one marked H, being hard and good, the other, marked S, being soft and perishable).

With regard to Mr. Daines's process, he had been called in (in conjunction with Mr. Smirke and others) to report * upon its application to the Houses of Parliament, without any reference whatever to its relative merits as compared with other processes; and they found that his experiments which had extended over six years, appeared generally to have had a good result, and were in the main very satisfactory. Where applied to stone which had already decayed, the process appeared to have stopped the progress of decay. The stone in parts, he believed from accidental causes, had become very black, but in other parts it appeared whiter and cleaner than the parts not treated. Oil without sulphur he knew was not durable, but as to whether sulphur made it durable he did not wish to give an opinion. He had examined, with Mr. Edward Barry, the parts treated by M. Szerelmey's process, and in justice to him must say that he could not detect any new decay. M. Szerelmey had done himself a great deal of harm by mystifying his process, but considerable allowance should be made for this. In adopting a disguise a man was almost compelled to resort to many little falsifications, and it was to be regretted that M. Szerelmey had laid himself open to a charge of something like deception by the inconsistent answers he had sometimes given to parry inquisitive questions. His use of the term *Zopissa* was mere *fudge*. However, from what he had that day seen, he could say nothing against the process as regards its preservative effects; it appeared to have hardened the surface of the stone, rendered it less pervious to water, and apparently stopped the further progress of decay.

Mr. Godwin, V.P., was anxious to gather, as much as possible, *facts*, and he would therefore contribute one fact, though it was unfortunately negative; indeed there had been scarcely time for any positive facts to be adduced. He could not, however, help expressing his great astonishment, on hearing the whole story of the selection of the stone for the New Houses of Parliament. It appeared that the stone was approved and that it was the act of the Commissioners; but after knowing that a Commission of architects, chemists, and practical men was started to go all round the country, not only to examine various buildings and quarries, but to analyse, weigh and so forth, it was somewhat surprising that they should find out to-night that the selection was agreed to by a part of the body of Commissioners from a little piece of stone, 18 by 9, sent up by Mr. Smith from the quarry selected by himself, because buildings of the same stone had stood so well. This statement must astonish every one who had heard it, and it appeared to him to call for some more definite inquiry and examination. The fact he wished to communicate had reference to Mr. Daines's process, and he mentioned it because he thought they must have facts (and negative facts if they could not get positive), and he referred to it without the slightest feeling in respect to Mr. Daines's process or any other. Some time ago Mr. Calder Marshall put up a statue of Captain Coram before the Foundling Hospital, and soon afterwards he (Mr. Godwin) observed that it was being coated with some preparation, which on enquiry he found was Mr. Daines's; and subsequently Mr. Calder Marshall gave Mr. Daines a testimonial expressive of his approval of the preservative qualities of the process

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* Vide page 186.

applied to that particular statue. Mr. Calder Marshall, when he signed that testimonial, no doubt thoroughly believed from the appearance it then presented that he was only saying what was correct. Ten or eleven months ago, however, it became evident that the whole thing had decayed, and seeing that it was accordingly being painted, he made a point of inquiring about it, and found that it had literally gone all to pieces; and that although there had been three or four applications of Mr. Daines's process it had failed entirely.* Under these circumstances he thought it most desirable to collect facts of this kind, and if they could not ascertain what processes would last, they might at all events satisfy themselves as to those which failed, and at once get rid of the latter in order to clear the ground.

Professor Ansted, Visitor, said that the subject under consideration was very large in itself, and was mixed up with many other important subjects. He thought it a pity that on the present occasion the discussion should have included two subjects, which were really distinct. He meant the nature of stone as used for building purposes, as well as the preservation of stone already placed in public buildings. No doubt an important question was, what stone should be selected for certain purposes, but every one acquainted with the subject must be aware that stone in quarries, in its natural state, varied so exceedingly, not only in different beds in the same quarry, but in different parts of the same bed, that it was impossible to say, off-hand, whether a particular bed or deposit hitherto untried, would give a good and durable material. He would, however, venture to remark that some of the eminent architects who had spoken on the subject of stone did not appear to be aware of the position of science in connection with it, and were hardly acquainted with what was already known as to the natural process involved in the original bedding of stone, or the circumstances under which the stone has been modified while buried in the earth. He stated that, in all cases, stone occurring in beds must necessarily contain large quantities of water, and that the different beds of stone varied very much in this as well as in other respects, being affected by exposure, and also by the nature of the beds immediately overlying. These latter, indeed, act mineralogically, tending to alter their nature, and architects would thus see that there did exist ascertainable reasons why particular beds of stone should be good or bad, even without external indications being traceable. Thus, where there were several beds of stone, forming a well marked sequence, and some of these cropped out to the surface, these out-cropping beds are comparatively hard, while those below, though identical in composition, are soft and cheesey in their texture. On the other hand, when the lower beds were worked, and afterwards exposed to the air, they were immediately subject to a drying process, which indurated the surface of the stone. He thought that, if a preservative process could be discovered which could be applied immediately after this drying operation, it might be successful; but if it were not applied until the surface became gradually and irregularly worn, and all the weaknesses of the stone were laid bare, no preservative process whatever would be sufficient to stop the permanent decay of that

* Mr. Daines states in reference to this:—One day, about two years and a half after the application of my process, the forepart of the right foot of the statue was found separated from the figure, the road adjacent being spread with loose granite, several pieces of which were found lodged upon the pedestal near the accident which was supposed to be the work of some idle boys throwing at the statue. However, this circumstance led to the proposition of Mr. Szerelmey to cover over my process, and the man employed by him broke the projecting finger of the right hand. Soon after from some unexplained cause the left hand holding a heavy scroll was early one morning found separated from the statue, certainly not from decay or decomposition, as I have it from Mr Calder Marshall that the original finger, portion of foot, hand and scroll were refixed by him, and only on account of the unsightliness caused by these disasters added to the patchwork appearance of the second process over mine was he induced to recommend the painting of the statue. Further to show that Mr. Marshall's opinion as to the efficacy of the process is unaltered; I am in possession of an order from him, dated September 1859, for a quantity of my solution, which I have since forwarded to Montrose to be applied upon the Hume pedestal there.

stone. He feared that there was no doubt that a large number of the stones of the Houses of Parliament had assumed such a powdery state that no process under heaven would prevent them from ultimately decaying. The decay might be stopped partially, but the time would come when the outer surface would exfoliate, and the weak parts would be again exposed, so that the preservative process would have to be repeated. The principle involved in Mr. Daines' process was that of choking the pores of the stone by putting in oil or bitumen and sulphur. He did not know what difference there could be between this mixture and drying oil. If this preparation was applied to a stone perfectly dry, and after a long dry summer, enough oil might be got in to saturate the stone to the depth of a quarter of an inch, or more. It would take a long time before such a quantity of oil would be got rid of by decomposition, and thus for a few years the stone would appear to be perfectly preserved, although in time, by the action of the atmosphere and the sun, the oil must inevitably be destroyed, after which decay would continue as if no oil had been applied at all. If, on the contrary, the oil was applied in the same manner after a wet summer, or in the month of November, it would not penetrate nearly so far into the stone, and evident decay would take place immediately. Referring to several stones on the upper part of Westminster Abbey, subjected to experiments made under the direction of Mr. Scott, Professor Ansted remarked that one of the stones had retained the oil to the depth of one-eighth of an inch, up to which depth the choking process appeared to be successful, but in the nature of things it amounted to nothing more than giving the stone a thick coat of paint. Another method, based on different principles, was that introduced originally by Dr. Fuchs, and carried out by Professor Kuhlman. This was not strictly a process of silicication. There were two ways in which silica had been applied,—first, by laying on the surface of the stone a solution of what was called *water glass*, which was nothing more than a silicate of soda or potash, and letting it remain there till it was acted upon by the atmosphere. Possibly, in very dry seasons, this might produce a deposit of hydrated silica, but in a state that did not seem likely to afford permanent defence to the stone. They should remember that all kinds of silica were not alike. Flint was one form,—opal another; the latter having much water, and the former very little, and the flint consequently being more durable than opal. When flint was combined chemically with water it did not appear to be a very durable stone. It might, however, happen that when the silicate of soda or potash was applied, decomposition took place, and then the silica combining with some of the lime of the lime-stone would produce a deposit of silicate of lime in the place of the hydrated silica. A third method of preserving stone involved double decomposition, and was that suggested by Mr. Ransome. The great question to be decided, he believed to be,—what was the application which would give a coating to the decaying stone identical with that mineral which caused the intense hardness in concrete and old mortar. In the proceedings of the Royal Society of Edinburgh he had recently seen a paper by Mr. Robinson, pointing out the condition of Portland and other cements during the process of hardening, and showing that as the hardening proceeded so at the same rate did the formation of silicate of lime. The mere deposit of a mineral mechanically, from a solution, was not necessarily the same as the deposit of that mineral when in contact with substances to which it had a tendency to adhere. He believed there was no doubt that silicate of lime was the hardening material, and then the question was, whether they were able to deposit it in the manner suggested by Mr. Ransome If so, the theory of the question was settled, and they could wish for nothing better, but how did it really work? This was not an easy point to determine, and architects must ultimately settle it for themselves, as a matter of experience. His inspection of the Houses of Parliament and Westminster Abbey showed him the difficulty of coming to a conclusion on this point. He could not compare the results of the different processes. Mr. Daines' oil process, as long as it lasted, threw off moisture,

and the stone appeared to be in a good state, but he could not tell how long it would last. Then he felt that he could not fairly compare Ransome's results with M. Szerelmey's, because the latter process was kept secret, and might include the use of oils. Mr. Faraday's report to the Chief Commissioner of Works pretty clearly showed that Szerelmey's process consisted in the application of Kuhlmann's silicate of soda, and afterwards coating the same surface with some oily preparation. It would not therefore be right to compare the results of stones preserved within the last year or two by these processes, because if the one involved the presence of an oily coat, there could be no doubt that a surface painted in the ordinary way would have been kept from mischief for that time. He believed that Mr. Ransome's early specimens were not done with the composition he now used, for he did not then use the chloride of calcium, but the chloride of lime, which might account for some irregularity in the condition of the specimens in the Houses of Parliament. In some places where it had been coated by Mr. Ransome the stone was very hard, and in others it was decaying. At Westminster Abbey in some places it had not answered its purpose, but it did not appear that the experiments were done with care, or the process repeated, besides which it was necessary to know the state of the stone at the time of the application of the process, and whether it was a hopeful case. A stone in hopeless decay was like a dying man, and could not be brought to life. Even if a certain amount of subsequent decay should appear, it was not to be assumed that the process had necessarily failed, though of course this took away from absolute success. On the whole he believed he might say, that of the various methods adopted the first of the three failed of necessity,—the second did not appear to have shown a satisfactory result, either in Paris, or in this country ; and he believed that even where it had been most successful, it had not been so successful as the third,—which was Mr. Ransome's process. Upon the whole, however, he did not think any satisfactory conclusion could be drawn from the observations hitherto made. The proposed Committee offered the best prospect of arriving at a satisfactory result, and the examples of preserved stone he had seen were not such as to render him certain or very hopeful of success. Something, however, must be done, although had it not been for the failure of the stone of the Houses of Parliament, people would perhaps have remained accustomed to a certain amount of destruction. Seeing that some stone was good and some bad, and knowing that some part had been badly or carelessly selected, they would have accounted for the whole of the bad stone in that way. As a proof that decay was not entirely owing to the climate, Professor Ansted referred to the excellent condition of Greenwich Hospital, the Portland stone of which he considered to be as hard and almost as beautiful as the marble of Milan Cathedral. He sincerely hoped that some good would arise from the inquiry they were about to institute.

The Chairman thought that instead of referring the matter to a Committee, it was desirable to petition Parliament that a Commission should issue to take up the question in its general bearings. Satisfactory information could not be expected from a body of architects alone, and a concentration of scientific men of various classes was desirable. He hoped at the next meeting some member would move the adoption of such a petition.

The discussion was adjourned to Monday the 11th of February.

DISCUSSION ON THE PRESERVATION OF STONE—CONTINUED.

February 11, 1861.

M. Digby Wyatt, Vice-President, in the Chair.

Mr. T. H. Lewis, Hon. Sec., read a letter from Mr. Daines, of which the following are extracts:—"Since Lord Lyndhurst brought my patented process, accompanied by a two years' certificate as to its efficacy from the late Sir Charles Barry, under the notice of the Government in the House of Lords, the object in every discussion has been aimed against the value of oleaginous and fatty matters. I therefore beg to state the inducements which led to my employment of linseed oil as set forth in my patent, dated 12th of August, 1854. On June 22nd, 1860, Messrs. Sydney Smirke, G. G. Scott, Arthur Ashpitel, Edmund Woodthorpe, Edward Mackmurdo, and James Ruttledge, M.D., confirmed the certificate of Sir Charles Barry, after a six years' test upon the walls of the Houses of Parliament.* From time immemorial oleaginous matters have been employed for the preservation of stonework from decay, and, when properly applied, simple linseed oil has been proved to resist the action of the atmosphere for periods of from 15 to 20 years. I set myself to work, therefore, to ascertain the most indestructible body which might combine with this long tried preservative process. I found that sulphur at a certain temperature was readily taken up and retained in solution by the oil, whilst during the process, the vegetable mucus of the oil is precipitated, and the watery particles evaporated, and their place supplied by the sulphur. It is stated by chemists that *an element by itself is incapable of change.* Sulphur may be by heat fused and converted into vapour, but in both conditions it retains its essential properties. Light, electricity, or magnetism are *per se* also incapable of changing it. A particle of sulphur ever remains the same individual indestructible atom of sulphur, and only in chemical union with other bodies does it disappear to us, and is incapable of detection by the perceptions of the senses. But when we dissolve this chemical union it appears again with all its essential characteristics being liberated from the combining influences of other substances, and appears again as simple sulphur, which is insoluble in water and suffers no change by exposure to air, and further it is known to be a decided foe to vegetation (a prolific source of decay in stonework) .It is a mechanical combination containing no deleterious properties likely to act chemically upon the surface or body of the stone, and thereby decomposing instead of preserving the basis operated upon. For these reasons I have selected sulphur as the basis of my indurating medium. The stone so treated becomes extremely hard and impervious, and so far as I have been able to test its preservative qualities, a period of nearly seven years, shows not only that no decay has taken place, but time seems actually to increase its hardness. The solution is simple and inexpensive in its application, and is applied with a common paint brush to the surface of the stone until it will absorb no more, and generally, five dressings will penetrate to the depth of from $\frac{5}{8}$ to $\frac{1}{2}$ an inch according to the nature and absorbent properties of the stone. My first specimens, of from 45 to 200 yards each, were completed in two days, whereas the two competing bays so much discussed prepared by Messrs. Szerelmey and Ransome upon the river front at the Houses of Parliament were commenced August 9th, 1859.

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* Vide page 186.

and supposed to have been completed on September 3rd, but the heavy driving rains of September made it necessary to re-operate on those specimens again on the 29th, and again on the 5th of October. The works executed by me at the Houses of Parliament, over a surface of nearly 2000 yards, have never been retouched by me; and further in all cases where my process may be employed so satisfied am I with its efficiency for the purposes intended that I am prepared to engage for any reasonable period of time to keep such buildings in a clean and perfect state of surface repair for the annual payment of 10 per cent. upon the original cost of the application of my process."

Mr. Ferrey said that a letter from Mr. Cole had been read at the last meeting, in which the writer asked for his (Mr. Ferrey's) experience of a process communicated to the Institute in a paper forwarded 18 years ago, and which was brought to his notice by the late Mr. Sylvester, whose reputation was acknowledged by the profession. This process was conducted with very simple ingredients, namely, a solution of alum, and a solution of soap, and had no pretension to enter into the stone, or to alter its character in any way, but only to preserve it temporarily, at least, from the effects of moisture. Soap and water, well mixed, in the proportion of $\frac{3}{4}$ of a lb. of mottled soap to one gallon of water was laid over the face of the stone with a large flat brush, so as not to form a froth or lather; and it then remained four and twenty hours to become dry and hard; when another mixture of $\frac{1}{2}$ a lb. of alum in four gallons of water, allowed to stand four and twenty hours, was applied over the soap. He had himself applied this process to several buildings, but he would not say that its good effects had lasted beyond a certain number of years. The first time he applied it was to a large brick building with stone dressings, in Dorsetshire, exposed to very tempestuous weather, which penetrated everything; and it appeared as if nothing but a coating of cement would remedy the evil. After the application of the above process, however, the building, for four or five years, effectually resisted all weather. Soon afterwards he applied it to another building with a like result. After a certain time the weather acted upon it, but the process was so cheap, and so easily applied, that it was worth the while of any one to apply it before resorting to the more costly methods which had been under consideration; the cost of doing a large house being not more than £3. It produced a transparent scale over the whole work, but did not materially alter the colour. It mellowed the effect and gave the work the appearance of age, but being transparent it preserved all those traces of construction which it was desirable to maintain. And he could add to this the testimony of a distinguished architect, Mr. Salvin, who had applied it in many instances with good results. It did not give a building the appearance of having been painted or stained, but rather that of a building that had gained the nice tone which everybody would desire to see it possess. He had thought it his duty to give his experience in this matter, and also to look at the great building which was so special an object of interest to them. On going over the Houses of Parliament that afternoon he had been surprised to find to what a small degree the mischief had extended; for after reading what he had upon the subject, he was under the impression that he should find pinnacles falling, canopies dropping, and all manner of evidences that it would be necessary to cut away a very large portion of the building. But he found that, although there were many defects, and that decay was going on, it was confined to particular parts of the building. It was difficult to speak as to the proportion, but he should say that probably not one five hundredth part was affected. The system of painting already adopted and proposed to be carried on entirely changed the whole expression of the building, and it appeared to him that it would be far more judicious to give Mr. Barry the charge of it, with instructions to cut out and renew such portions as are really and completely corroded. If they looked at the magnificent carvings round the whole of the various courts, he believed they would not find a trace of decay in any one of them. He found that the parts which were most in a course of corrosion or destruction were those where the

water had come over the weathering and run down the wall. No doubt decay had gone on, and was going on still, but he could not think to such an extent as to demand a remedy which would be so entirely destructive to the effect of the building as what he had seen there. He went through the Speaker's court, and must confess he should have supposed it had been painted. And if Mr. Ransome's process produced the same effect it was objectionable. If those processes were to be applied, they should be so only to those parts which were affected, and not so as to cover the whole with one general coating or wash. He had been most painfully impressed with the statement made at the last meeting that whether *zopissa*, or any other process, was applied, the disintegration which was going on in the stone itself could not be checked; and he thought, therefore, that instead of incurring such a vast expense, it would be much better that the decayed parts of the stone should be cut away, and replaced from time to time. He was strongly impressed with the undesirableness of proceeding over the whole building with either the zopissa or any of the other processes which had been described.

Mr. Edward Barry, Fellow, said that in the position he had the honour to occupy with reference to the New Palace of Westminster, he was naturally anxious to address a few words to the meeting, if only in explanation of some of the statements which had been made. The discussion had branched out into two distinct heads,—one bearing upon the selection of the stone, and some subsequent transactions connected with that matter: and the other with regard to the processes now under consideration for the prevention of further decay; and he would therefore say a word or two on both those subjects. But before he did so, he must be allowed to thank Mr. Ferrey for anticipating him in his protest against the gross exaggerations which had been made in many quarters as to the decay of the stone in the building. That there was decay was unfortunately too true, but it was chiefly in parts which might easily be particularized. It was, however, perfectly untrue to say, that the decay was general, or that it extended over anything but a minute fraction of that large building. As regarded the choice of the stone, it was selected, as they all knew, by a Commission, which was certainly thought at the time to merit the confidence of the Government, and the scientific world. They had been rather startled at the last meeting by a statement, or rather an inference from a statement, that the quarry was changed after the first selection, and that it was changed in consequence of a visit by one of the Commissioners, and the sending up to London by him of a small piece of stone 18 inches by 9. That he thought was the impression conveyed to the meeting, but believed it was not the impression intended to be conveyed, and he had reason to know that it was entirely incorrect. The visit was paid, and the piece of stone was sent up; and the result was another visit of the Commissioners to the spot, and the change of stone resulted from that visit. Therefore whether the change was right or wrong, whether it was wise or unwise (and it was now very easy to say it was either), the Commission was entirely responsible for it. The original selection of the stone must have been, as it always is, an exceedingly difficult subject. No one could have heard the discussion which had already taken place, and the cautious remarks of Professor Ansted, characterized by all the moderation of true science, without feeling that very few of them were in a position even now to dogmatize as to the choice or selection of stone. His father was certainly appointed on the Commission, and he presumed exercised some influence upon it, but those events occurred beyond the limits of his own recollection, and he could only speak of them by assumption. He did not think, however, even if his father's opinions had differed from those of such distinguished geologists as Sir Henry de la Beche and Dr. Smith, or such an able practical geologist as Mr. C. H. Smith, that he would have pressed his opinion; and, indeed, he doubted whether many architects would be prepared to maintain their own opinion on such subjects against such authorities. But they had been told to look at the Museum of Economic Geology, where it was said care had been taken in the selection, and which building had

succeeded, whilst no attention had been paid to the selection at the Houses of Parliament, which had failed. It was very easy to say, that if something had been done which had not been done, something which had happened would not have happened, but it appeared to him that the analogy failed; because, if they would examine carefully the Museum of Economic Geology, they would find that it was not true that there was not a stone faulty in it, as had been stated. On the contrary, there was a considerable amount of decay; he would not say there was so much relatively as at the Houses of Parliament, but he thought the difference of position should be taken into account, because the Museum of Economic Geology was not situated on the banks of the river, or rather a gigantic sewer, with potteries on the opposite side of it. Whatever might be the comparative state of the two buildings, it was pretty clear that the same care in selection had been taken in one case as in the other. Indeed, this part was disposed of by the straightforward letter of Mr. Grissell,* and he much wished that gentleman had been present to corroborate his statement. Those who knew Mr. Grissell knew the high character he had maintained through all his business connection with the Houses of Parliament, and if there had been any mistake in the selection of the materials Mr. Grissell himself would be the first to regret it. For his own part he did not believe it had occurred. With these remarks he would pass on to what was possibly the more important subject now, namely, the measures to be taken to prevent future decay, and to arrest the progress of the decay already existing. It would not be supposed by those who knew the anxiety and the deep interest his father took in all his works, that this subject had escaped his attention, or had caused him anything but anxiety for a long series of years. No less than six or eight different processes had been tried under his direction at the New Palace of Westminster. There was one highly recommended from France, which was tried, another from Germany, another invented by Mr. Daines; one or two more of which he had no personal knowledge; then there was Mr. Ransome's; and lastly, Mr. Szerelmey's. Many of these had been applied for a considerable time, but no very distinct result had been attained before his father's death; and on his own appointment to the charge of the building, the first instruction he received was that Mr. Szerelmey's process had been adopted, and was to be applied by that gentleman on a somewhat extensive scale. Up to that time he (Mr. E. Barry) had paid but a cursory attention to these processes; he was aware they were being carried on, but he might say that he had never had any great faith in any process of the kind and had not directed his attention specially to the subject. When, however, he was called upon to apply this composition to the building, he felt very anxious and very desirous to ascertain as far as possible what facts and data there were which might enable him to form an opinion on the subject. He was well aware that the result of his father's inquiries had led him to form a very decided opinion in favour of Mr. Szerelmey. In fact, Mr. Szerelmey had completely gained Sir C. Barry's confidence, by the experiments which he had made—so much so that one time Sir C. Barry had personally assisted Mr. Szerelmey out of his own pocket, in order to enable him to pursue his investigations and purchase materials for doing so. In making his own inquiries on this subject, he (Mr. E. Barry) had of course been met by the great stumbling-block which they all felt to be a difficulty, namely, the secresy in which Mr. Szerelmey had thought fit to envelope his process. It had been already said that Mr. Szerelmey had hardly done himself justice by the mode he had adopted. In that remark he fully concurred, and thought Mr. Szerelmey had shown a remarkable ignorance of the character of Englishmen. If he had understood that character better, he would not have said so much in the letter which he had addressed to the Council, about the danger of his experiencing unfair treatment because he was a foreigner. There was in fact no surer way to

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* Vide page 158.

excite distrust than by an affectation of that secresy which was really unattainable, and which, if it were attainable, would be inconsistent with the interests of true science. However, as that secresy existed, he (Mr. Barry) was thrown back upon investigations of another character. The only information available were the reports of Professor Faraday and Sir Roderick Murchison; and these were so important as bearing on the case, and were so entirely dispassionate and impartial, that he begged permission to call the attention of the meeting to some of their more salient points, and in doing so he would quote a Parliamentary Paper, which any one might obtain for himself. In July 1859, Dr. Faraday wrote as follows to the late Rt. Hon. Henry Fitzroy:—

Hampton Court Green, 1 July, 1859.

Sir,

I had the opportunity yesterday of seeing Mr. Szerelmey, who communicated to me, *in confidence*, his process, with a slight reservation. I find nothing in his mode of procedure which is objectionable or otherwise than good, or which would upon *principle*, cause me to doubt the success of his process when properly applied. I may say the same also of other processes, founded by other persons upon the application of alkaline silicates.

Such being the case, we then turn to the results of observations, trial, and experience, without which no method can be judged of or finally approved. The trials at the Houses of Parliament have extended to periods of two or three years. That the stone of the building requires protection upon the external and weather faces is very manifest; nor can that surprise us when the condition of the London atmosphere, especially in relation to the sulphur acids derived from the coal, and the calcareous nature of the stone, are considered. In my opinion, the results of the trials (and I may say large experiments) made by Mr. Szerelmey are better than any of the rest; and, so far as one can form a judgment upon the experience of two years, justify the expectation that the process will sustain its character for a lengthened period of time. I think it necessary to say that a process, good in principle, may fail if carried carelessly into practice. Mr. Szerelmey's process has had the advantage of being carried out under the guidance and inspection of himself, the person most fitted for that purpose, and most interested in its success.

I am, &c.

The Right Hon. H. Fitzroy, M.P. (signed) M. Faraday.

As a consequence of that, the Board of Works allowed Mr. Ransome to apply his preparation to one bay of the building, and Mr. Szerelmey to apply his to another. When these were finished, Dr. Faraday and Sir R. Murchison were asked to examine them, by the following letter dated 6th March, 1860.

Office of Works, &c. 6 March, 1860.

Sir,

I am requested by the First Commissioner of Her Majesty's Works, &c., to request that you will have the goodness to examine, in concert with Professor Faraday, the stone-work of two bays of the river front of the New Palace at Westminster which has been indurated by two different processes, respectively applied by Mr. Ransome and Mr. Szerelmey, and to report to him which of those processes you consider best adapted to the purpose, and whether you can recommend either of them for general use in the building.

Mr. Phipps, assistant surveyor of works, of this department, will point out to you the two bays above referred to.

I am, &c.

Sir R. Murchison. (signed) Alfred Austin, Secretary.

A similar letter to the above was addressed to Professor Faraday.

On the 3rd March, Mr. Phipps had certified that the two bays were in a proper state to be handed over to the referees, and on the 6th the above letter was written. On the 12th of March, Dr. Faraday made the following report:—

Royal Institution, 12 March, 1860.

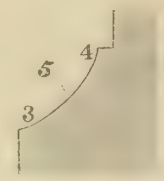
Sir,

In relation to the preservation of the stonework of the New Palace of Westminster, I hope you will do me the favour to refer to a letter on the subject of Mr. Szerelmey's process, which I wrote to the late Chief Commissioner on 1st July, 1859; it will make it unnecessary at this time to refer to anything more than the two bays, to which the attention of Sir Roderick Murchison and myself have been directed. Mr. Ransome prepared the south bay, which I will call No. I.; Mr.

Szerelmey prepared the north bay, No. II.; both were cleared of the loose surface by hard brushing, &c., and then dealt with. The time which has elapsed is about six months; and if the processes are of any value, is hardly sufficient to show a difference due to weather.

Compared together, I. has more of the natural colour and appearance of the stone than II.; it is softer, wets immediately, and by degrees the water is absorbed. No. II. is darker, an effect due to the varnish-like character of the last coat applied; is harder, and does not absorb water; the fluid runs from off it. The repellent coat appears to have much permanency, for alcohol and turpentine do not disturb it.

Though the time of trial is short, there is a place where, I think, evidence of difference appears. At a part of the wall having this form rain droppings have fallen on the part below 5, whilst that above has escaped; consequently the stone 3 has suffered more than 4; and this is very evident in many of the untouched bays. In the prepared bays (where the loose surface had been removed before preparation) I looked for a six months difference at these parts. In the bay II. I could find no sensible difference between the parts 3 and 4, both were equally hard and in good character; in the bay I., 3 was softer than 4.



I do not find in other parts of the building, where Mr. Szerelmey's application is more than two years old, any signs of exfoliation, or separation of the prepared face of the stone; or any ground for fears in that respect. On the whole, therefore, and though the time of comparison is short, my belief is that his process will prove to be the best.

Though ever ready to aid the Government when it lies within my power, I am not professional. May I therefore be permitted to ask as a favour, that my opinion should not be communicated to either of the parties concerned to serve trade purposes.

I have, &c.

The Right Hon. W. Cowper, M.P. (signed) M. Faraday.

Sir R. Murchison wrote to say, that he entirely agreed with Dr. Faraday; and in a private letter which he wrote at the same time, he expressed himself even more strongly than in his official letter.

28, Jermyn Street, 12 March, 1860.

Sir,

Having perused the Report made to you by Dr. Faraday, I beg to express my entire concurrence in the opinion he has given.

I have no hesitation in saying that the process of Mr. Szerelmey is the best of the two processes for the induration of the stone used in the construction of the Houses of Parliament, which were submitted to our joint examination.

The process employed by Mr. Szerelmey has, it seems to me, a great advantage over the other, inasmuch as I was informed by the clerk of the works that it was completed with more rapidity than the method employed by Mr. Ransome.

Permit me to add the expression of my hope, that steps may be taken without delay to arrest the rapid disintegration of the stone which is going on in many parts of the building.

I remain, &c.

The Right Hon. W. Cowper, M.P. (signed) Rod. I. Murchison.

The next letter in the series was one addressed by Mr. Ransome to the Chief Commissioner, on the 2nd April, 1860:—

Ipswich, 2 April, 1860.

Sir,

It was with extreme surprise that I learned from you at our late interview that your honourable Board had already decided to report in favour of Mr. Szerelmey's process for preserving the stone of the New Palace at Westminster, as compared with mine, and (as I gathered from your remarks) upon the ground that the stone treated by Mr. Szerelmey was less absorbent than that treated by me.

I beg respectfully to submit that by such decision, the understanding that existed between the late Board of Works and myself (and alluded to in their letter of the 11th of July of last year) has not been carried out, and that the conditions under which the matter has been referred to Dr. Faraday and Sir R. Murchison, were not such as to secure a "fair testing of the respective processes," nor has "a sufficient time elapsed" since the making such applications to enable those gentlemen, in the absence of a knowledge of the details thereof, to arrive at a sound or satisfactory conclusion thereon.

The report alluded to being confined to an external and superficial examination of the small portion of the wall operated upon by Mr. Szerelmey and myself by the direction of your late honourable Board in the autumn of last year, it is clear that it was utterly impossible for the referees to form a correct opinion of the *permanent* merits of the respective processes.

It is well known that surfaces coated with oleaginous or other organic matter will for a time resist the penetration of moisture, but such coating soon becomes decomposed by exposure to the oxidising influences of the atmosphere.

By analysis made by some of the principal chemists of the day, I have ascertained that the "secret process" of Mr. Szerelmey is composed principally of such organic matter. The details of such analysis I submitted to your late honourable Board, and in confirmation a practical illustration upon a large scale is afforded by the failure of the application of that process to the "Speaker's Court."

For the interest of the public and in justice to myself, I am bound to call the attention of your honourable Board to the fact that the restricted conditions under which the matter was referred to Dr. Faraday and Sir R. Murchison, precluded them from reporting upon the effects of Mr. Szerelmey's operations upon the walls of the Speaker's Court, and comparing them with my operations at the New Palace of an earlier date.

In conclusion, I would respectfully submit that the only course that will be satisfactory to the public, and fair towards myself, will be that a chemical analysis of the details of our respective processes be made and reported upon by independent and competent men, and that the decision and report of your honourable Board be suspended until a "sufficient period" of time has elapsed for effecting the decomposition of any organic matter which either process may contain, and for revealing the merits or defects due thereto.

I have, &c.

To the Chief Commissioner of Public Works, &c. (signed) FREDERICK RANSOME.

With reference to that protest, the Board of Works on the 19th April, 1860, made another application to Dr. Faraday. To this Dr. Faraday replied on the 20th:—

Royal Institution, 20 April, 1860,

SIR,

I think it will be sufficient if I state that I was quite aware of the general matters contained in the copies of letters from Mr. Ransome, which have been sent to me. I knew that both Messrs. Ransome and Szerelmey used soluble silicates and the latter in addition a final coat of bituminous or other such like matter. I have also not forgotten the Speaker's Court, and other parts of the Houses of Parliament. My former letters have been very carefully expressed, and I think I have distinctly stated that I could not decide upon principle only, since either process, or both, might fail after the lapse of years through want of care or other circumstances: but being thrown upon the short and insufficient evidence now existing, and taking into consideration as far as I can the two processes, my belief is now, as it was when I last wrote, that Mr. Szerelmey's process will prove to be the best.

I have, &c.

The Right Hon. W. Cowper, M.P. (signed) M. FARADAY.

This was not twelve months ago; and as Dr. Faraday's opinion then was that Mr. Szerelmey's process was the best, he presumed his opinion would be so still, unless some new circumstances were imported into the case. Having read this correspondence so as to give the statements and objections on both sides, he would leave it to the meeting to form an opinion upon them; but he felt bound to say, that after a careful investigation of the works since that date, he saw no reason whatever to contradict Dr. Faraday's and Sir R. Murchison's report. As far as the evidences of the senses went, Mr. Szerelmey's process appeared to have been successful. How long it might continue to be so, or what might be its component parts, he had no reason of knowing. They had heard something about the Speaker's Court, and that the preparation which had been applied there had come off the walls in

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THE FOLLOWING CORRESPONDENCE HAS ALSO TAKEN PLACE:—

Ipswich, Dec. 4th, 1860.

DEAR SIR,

So much has been inferred and publicly stated to my disadvantage, as the result of your opinion expressed concerning the comparative merits of Mr. Szerelmey's process and mine, for preserving the stone of the New Palace at Westminster, that I hope you will pardon me for asking you whether your Report was not in substance to the following effect:—

First. That although it appeared to you that the composition of Mr. Szerelmey rendered the Stone, at that time, less absorbent of water than mine, that it was impossible within so short a period as had elapsed from the time of the application of the two processes, to come to any satisfactory conclusion as to which of the two would be more or less permanently beneficial; or whether either would ultimately be attended with failure or success.

Secondly. I would further venture to ask you whether it is possible for the most able and competent judges, in the absence of chemical analysis, or a full knowledge of the details of the processes, to pronounce an opinion, within the time

flakes or dust. He did not think that statement was borne out by the facts of the case; but, nevertheless, when it came to his knowledge that the Speaker's Court was being covered again, he interfered and stopped the process, and there were parts there which had not been touched since they were originally done three or four years ago, and these were accessible to all. He did not himself think it had failed there; but whether it had or not could easily be determined. Several parts of the building had been treated several times. Mr. Ransome had treated portions of the river front close to the Speaker's Entrance several years ago, and did not appear to him to have succeeded at all. He had this day had all the parts which had been treated, labelled with the names of the inventors, and the dates at which the processes had been applied; and he should be happy to afford access to them, and the means of thereby forming a judgment for himself, to any gentleman who might wish to examine them. If the present discussion was intended to terminate in the appointment of a committee, or any measure of that kind, he should beg leave to offer a few remarks on that point.

The CHAIRMAN said the Council were in the hands of the meeting, but their opinion was that a Committee of their own body only would not be satisfactory. They thought the matter of sufficient national importance to justify the Legislature in forming a Commission of competent persons to

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that had elapsed, upon the permanent and final effect of either process, which would justify its application at once to the entire surface of so important a building.

If you would kindly favour me with a reply at your early convenience, informing me how far I have, in the foregoing, fairly stated the *facts* of the case, and will, at the same time, express your consent that I may place the same before the public, for the purpose of correcting the erroneous statements which have been publicly made, I shall feel greatly obliged, and I beg to remain,

Dear Sir, Your obedient Servant,

M. Faraday, Esq., D.C.L., &c. (signed) FREDERICK RANSOME.

Royal Institution of Great Britain, December 6th, 1860.

DEAR SIR,

Your letter of the 4th instant contains two numbered paragraphs, and asks me whether, No. 1 does not convey the meaning and intention of my reports to the Chief Commissioner of Works therein referred to :—to which I answer, *Yes*.

The paragraph No. 2 enquires whether I think any person without chemical analysis or a full knowledge of the details of the processes would be justified in giving a certain opinion. For my own part, with or without this knowledge I should not feel myself justified in giving such an opinion. The result looked for is eminently practical, and in either case can only be obtained by the lapse of time.

I am quite willing that you should use this letter in any way that you please.

I am, &c.,

Fredk. Ramsome, Esq. (signed) M. FARADAY.

Geological Survey Office, 28, Jermyn Street, December 11th, 1860.

DEAR SIR,

In reply to your letter of the 8th, I have to state that my examination of the stone used in the construction of the Houses of Parliament was, by the directions I received, confined to two "bays" only, on the river front, the one prepared by your process, and the other by that of Mr. Szerelmey.

Having no other knowledge of the ingredients employed, except that both preparations were eminently siliceous, I simply agreed with Dr. Faraday, that of the two bays in question that which had been treated by Mr. Szerelmey had *then* the most perfect and uninjured surface.

Having read the copy of the answer of Dr. Faraday to your queries, which you have transmitted to me, I may add that I quite coincide in the opinion he has expressed, "that the result looked for is eminently practical, and can only be obtained by the lapse of time."

I remain, dear Sir, &c.,

Fredk, Ransome, Esq. (signed) RODK. MURCHISON.

investigate the subject, and bring to its solution as great an amount of talent as the country could supply.

Mr. E. Barry fully concurred in that opinion. A Committee of the Institute only would be open to the charge of dealing only with particular cases, and its opinions would be quoted by interested parties in a manner not likely to be satisfactory to the members generally. There were other objections to which he need not allude, but he believed the subject had occupied the attention of that department of the Government which had the care of the New Palace. Whatever course might be adopted, his own earnest desire would be to co-operate with any body of gentlemen who might be appointed; because he felt very greatly the responsibility of his own position, and his only anxiety was that the very best thing that could be done under the circumstances might be adopted. The present suggestion of a committee was not a new one; for in December last he had himself formally advised the Board of Works to the effect that the whole matter should be referred by them to such a committee as should claim their confidence by their scientific and professional attainments; and he believed that was the only course which would justify the Government in deciding on the course to be pursued. For himself he would not take the responsibility of recommending any secret process whatever.

Mr. Godwin suggesting that it would be desirable that such gentlemen of known scientific ability as might offer any remarks, would be kind enough to state whether they had been employed professionally by any of the inventors or patentees of the processes under consideration.

Dr. Hofmann, who had been called upon by the Chairman to offer some remarks, said that he had not been so employed. His advice had been asked on the subject by the Chief Commissioner of Works, more particularly within the last six or eight weeks. The task which was thrown upon the shoulders of the chemists in this case was one of great difficulty, arising, in a great measure, from the element of *time*, which almost precluded the possibility of arriving at a due appreciation of the success of any mode of preservation. In order to test the value of a method, it would be necessary to devise a process imitating the tooth of time, and enabling us, within a limited period, to produce the changes, which, under ordinary circumstances, are the work of ages. The processes hitherto proposed were based upon two perfectly different principles. Some of them were intended for temporary preservation, and others for final and permanent preservation. The former appeared essentially to consist of agents which sealed up the pores of the stone, so as to render it impermeable and inaccessible to the action of water. The latter were intended to produce a permanent alteration in the constitution of the stone itself. Various causes had been stated and explanations given to account for the weakness of the stone of the New Houses of Parliament. A combination of several causes was probably involved in this result. There could be little doubt that the extraordinary facility with which the stone absorbed water had something to do with this. The stone absorbing water like a sponge took up, together with the water, the atmospheric constituents which acted upon it, such as carbonic acid, invariably present in the air, or minute quantities of sulphuric acid, the product of combustion of the sulphur in coal, which abounded in the atmosphere of London. But a greater cause of mischief arose when the water absorbed by the stone became frozen. Everybody knew that, in the process of congelation, water expanded with an irresistible force, overcoming the most powerful obstacles. If the pores of the stone could be permanently sealed, the process of disintegration would certainly be retarded, if not altogether avoided; in other words, if a *permanent* agent could be found to exclude the access of the atmosphere and water, the task before us would be half solved. But all the agents yet proposed for that purpose, so far as he knew, had been of a perishable character. Of a perishable nature was oil. So long as the oil remained, the water would

be excluded, but the atmospheric agents would gradually but surely destroy the oil, and the stone would then remain in the same condition in which it was before the oil had been introduced. The proposal to boil the oil with sulphur had no chemical foundation; the presence of sulphur could not in any way, he knew, increase the permanence of the oil. He certainly believed that stone could be *temporarily* preserved by linseed oil and other oily substances;—the best time for the application of which would be the height of summer, when the stone contained as little moisture as possible.

The processes intended for permanent preservation had been in a measure explained by previous speakers, but there appeared to be some misapprehension as to the action of the process originally proposed in Germany by Fuchs, and subsequently elaborated and expanded in France by Kuhlmann. The theory involved in this process was, in a measure, what chemists would call a theory of probability, inasmuch as it was only to a limited extent capable of demonstration by experiment. The process consisted in the introduction into the stone of a solution of silicate of soda, the action expected to take place being two-fold. In the first place a double decomposition was assumed to arise between the carbonate of lime (and carbonate of magnesia) of the stone and the silicate of soda, silicate of lime and carbonate of soda being produced. In the second place the carbonic acid of the atmosphere was assumed to decompose the silicate of soda with formation of carbonate of soda and separation of silicic acid, the carbonate of soda being removed by the rain in the same measure as it formed. It was further argued that, both reactions taking place slowly and gradually, the silicic acid separating in the first reaction, would, by combining with the lime of the stone, produce a hard crystalline compound similar to that which is found in old mortars, whilst the silicic acid eliminated in the second reaction by the carbonic acid of the atmosphere would be deposited as a hard cement between the particles of the stone.

Ransome's process, on the other hand, consisted in the combined use of silicate of soda and chloride of calcium, or muriate of lime, as it was formerly termed. The action of these substances upon one another gave rise to a double decomposition, the silicic acid of the silicate of soda combining with the lime of the chloride of calcium to produce silicate of lime, whilst the soda and the hydrochloric acid assumed the form of chloride of sodium or common salt. The same double decomposition it was proposed to accomplish within the pores of the stone by submitting it consecutively to the action of silicate of soda and chloride of calcium, in the expectation that the silicate of lime would mix with the substance of the stone, the common salt being carried off by the rain. So far as his own experience went, the experimental evidence adduced in support of either of these views was not sufficient to form the basis of a just appreciation of these processes. In favour of the process proposed by Fuchs and Kuhlmann it might be said that chalk, a substance remarkable for its softness, was hardened under the influence of the agents recommended. This any one could prove by immersing a piece of chalk in silicate of soda, when, after a certain lapse of time, an efflorescence of carbonate of soda would take place, indicating the decomposition of the silicate of soda, and the separation, in some form or other, of silicic acid, to which the hardening of the chalk must be ascribed. With regard to Mr. Ransome's process there could be no doubt that the action of silicate of soda upon chloride of calcium would give rise to a double decomposition, carbonate of soda and silicate of lime being produced; in fact the interchange had been experimentally illustrated to the meeting; but if the decomposition took place in a glass vessel, the silicate of lime separated in the form of a jelly, drying up to a more or less friable powder, and it remained to be seen how far this effect would be changed if the reaction took place within the pores of the stone, more especially how far the separated silicate of lime would become an integral part of the stone, instead of being deposited in the form of a loosely coherent powder within the interstices of the stone. Mr. Ransome, whom he

had the pleasure of seeing among the visitors, might perhaps be able to give some information upon this subject. He might ask, perhaps, Mr. Ransome, whether he had satisfied himself experimentally that balls or bricks formed out of powdered chalk or stone, when submitted to the consecutive treatment with silicate of soda and chloride of calcium will harden into stone-like masses? Experiments of this kind would greatly assist in elucidating the value of his process.

At present, as he had said, there was not sufficient experimental evidence at our disposal to decide in favour of either one or the other of these processes. If the theoretical reasoning could be relied upon, he had no hesitation in stating his belief that the chances were in favour of the original process proposed by Fuchs and Kuhlmann.

In their process the action, being the result of the extremely minute quantity of carbonic acid in the air, took place extremely slowly and gradually,—the silica thus gradually separated was, in his opinion, much more likely to become an integral part of the stone, forming a silicate of lime. The very fact of this decomposition requiring so much time, which, on the one hand, was a great obstacle to the application of the process, was, he believed, on the other hand, one of its advantages; for he was afraid that even supposing the silicate of soda could really be mixed with the chloride of calcium within the pores of the stone so as to give rise to the decomposition he had endeavoured to explain the probability of the rapidly separated silicate of lime becoming part and body of the stone appeared to him rather slender. He did not wish to press the distinction thus drawn between the two processes, but since the question before them was one of almost national importance, and since he had been specially invited to attend the meeting, he had thought it right to speak his mind on the subject. He believed the discussion had done an immense deal of good, and that the attention of chemists generally having been directed to the subject, could not fail to elicit numerous suggestions. Everybody must feel that the resources of chemistry were by no means exhausted in the proposals hitherto made with reference to this subject. A considerable number of substances could be named well deserving to be carefully examined by those who were interested in the preservation of stone; and he could not sit down without calling attention to some compounds well known to chemists, which, if it were only possible to obtain at a sufficiently low price, appeared to him to promise extremely favourable results. These compounds were the silicic ethers. In the silicates of lime, soda, and potash, the meeting had become acquainted with some mineral salts of silicic acid; this acid not only combined with mineral bases, but also with organic bases, more especially with the organic base contained in spirits of wine or alcohol. This base was frequently called *ether*, and it was known to combine with acids, producing a great variety of compounds, some of which, such as *acetic ether*, for instance, were well known for their uses in medicine. Ether was found to combine also, and in several proportions with silicic acid, giving rise to the class of bodies which were known as *silicic ethers;* some of these substances possessed such remarkable properties that he was surprised that chemists had never thought of them as applicable to the preservation of stone. One of the silicic ethers boiled at as high a temperature as 660° of the Fahrenheit scale; it contained nearly half its weight of pure quartz, the rest consisting of ether. This silicic ether had the remarkable property of undergoing decomposition in contact with water, and of reproducing the silica with separation of alcohol. These were simple facts with which every chemist was familiar. Silicic ether left in an open vessel, in contact with *moist* atmospheric air, became gradually transformed into a hard transparent mass of hydrated silica, resembling quartz in appearance, the whole of the ether being volatilized. The question then arose whether this agent could not be used for the preservation of stone; whether it might not be desirable to saturate the stone with silicic ether in the expectation that within its pores the same reaction might be gradually accomplished which occurred when it was exposed to the action of the atmosphere in a glass vessel?

A very serious objection to the application of silicic ether presented itself in the high price of this substance, but entirely confirming, from his own experience, Mr. Barry's statement of the extremely partial nature of the decay at the Houses of Parliament, he thought a material more expensive than those hitherto proposed might possibly not be out of the question. Silicic ether had an additional advantage, inasmuch as it appeared to lend itself both to the temporary and permanent preservation of the stone. This substance had the character of an oil; it certainly did not float on water like oil; being heavier than that liquid, it sunk, but it was insoluble in water and would not mix with it, which was the essential character of an oily substance. A stone therefore saturated with silicic ether would be very much in the condition of a stone saturated with one of the common oils; it would become impermeable to water, and thus receive temporary preservation. [Dr. Hofmann produced two stones from the Houses of Parliament, and showed that in one (which had been treated with silicic ether) the water remained upon the surface as if the stone had been saturated with oil, whereas in the other the water was rapidly absorbed]. In preventing water from entering the stone, the silicic ether would effect the temporary preservation of the stone, until, by its own decomposition, it had deposited within the pores of the stone the indestructible material intended to secure its permanent preservation. He however, merely threw out this suggestion with the view of directing the experiments of practical men to this class of substances in general. Hitherto silicic ether had been only a chemical curiosity, a substance exclusively of scientific interest, but, whilst he was examining into the means of protecting stone, the remarkable combination of properties which distinguished silicic ether had repeatedly fixed his attention. No doubt the present price of the material was high, so as to preclude altogether the idea of using silicic ether as a substitute for the cheaper silicates employed in the processes hitherto suggested. But who ever had any experience of chemical operations must know how essentially the price of an article depended upon the demand, and on the scale on which it could be produced. If, to day, you were to ask for an ounce or a pound of a particular substance, you might not get it for either love or money, but if you were to ask for a hundred weight, it would be offered to you by the ton to morrow. The primary materials required for the manufacture of silicic ether were of the commonest kind, and knowing, as he did, the enterprise and the resources of the manufacturers of this country, he thought, they might possibly be able to produce silicic ether at a sufficiently low price to render it capable, at all events, of local application in those parts of the stone of the Houses of Parliament, in which disintegration had actually taken place. Under the most favourable circumstances, silicic ether would always be much more expensive than the agents hitherto proposed, and it would therefore be scarcely possible to apply it to the whole building, but agreeing, as he had stated already, entirely with Mr. Barry that the decay was very partial, he thought it would not be necessary to apply whatever agent might be adopted to any except the actually decaying portion of the building.

The Chairman referred to Professor Ansted's statement that when once any action tending to decay had set itself up in the interior of the stone the application of any preserving process must be nugatory; and inquired whether the process suggested by Dr. Hofmann as useful in its general tenor, would tend to rectify the action which might have been already set up, by the absorption of dilute sulphuric acid or otherwise.

Dr. Hofmann could not answer the question in the form in which it was put. A great deal of the mischief was certainly done by the absorption of water, which this material would prevent; but supposing that a certain amount of deleterious matter had been absorbed from the atmosphere it could scarcely be hoped that silicic ether, the action of which he had endeavoured to explain, would assist in abstracting it. At the same time he did not believe any other process would do so.

The Chairman assumed that the substance suggested being to a certain extent repellant of

water, it was a necessary condition that the stone should be free from moisture at the time of the application of the silicic ether.

Dr. Hofmann assented to this. Looked upon from this point of view the substance would come under the class of temporary protectors, possessing as it does the characters of an oil; and it was obvious that oil could only penetrate the stone when it was perfectly dry.

The Chairman said it appeared that there was a general objection to the process of Fuchs and Kuhlmann owing to its tardy action. He wished to know whether in the London atmosphere, and with the vicissitudes which stones used externally were subject to, the water glass might not be washed out or got rid of before the additional action necessary to permanent preservation had had time to set itself up. Was that a contingency that might happen?

Dr. Hofmann said that in his opinion this contingency might certainly arise. If a building could be so protected as to avoid the constant washing by atmospheric water, the success of the process would be far less doubtful; and for this reason he thought the process alluded to had been found far more beneficial in warm and dry climates, because the agents were not removed at the same rate as in this country.

Mr. White inquired how the silicic ether would be affected by frost, as he believed the other processes were rendered perishable by expansion and contraction, and so became pulverized upon the surface of the stone and then broke up.

Dr. Hofmann, in reply, stated that he had not made any extended series of experiments on the material which he had mentioned, and could not, therefore, answer that question. He had simply stated some facts well known to all chemists, but which he thought might be acceptable to a meeting of architects. Silicic ether was described in every Manual of Chemistry and he did not bring this compound forward as an invention of his own. He thought, however, that the substance was well worth trying, and he had named it in conversation to the Chief Commissioner of Works, who had suggested that some experiments on a large scale should be made. By exposure to moist atmospheric air, in small laboratory experiments, silicic ether had deposited silica of such a degree of hardness as to scratch glass with perfect ease. This deposit was quite impervious to water, and he could not better describe its character than by comparing it to a piece of agate.

Professor Tennant, after expressing his concurrence in the partial nature of the decay in the Houses of Parliament, read a paper giving his views on some of the scientific points in question. He had heard it said "That an Englishman is never happy but when he is grumbling." The stone used in the construction of the Houses of Parliament had recently afforded the public a little opportunity of gratifying the grumblers, and he thought more had been made of it than was warranted. Two years since he took a Russian engineer over the buildings, and examined them minutely. He assured him (Mr. Tennant) that it was only in England that a building so extensive and uniform throughout in design and materials, could be completed in the time, and for the cost £1,500,000. In Russia, it would have taken double the time, and the expense would have been 20 to 30 per cent. more: one monarch or architect would have died, and then some change in the design would have been made. Let them look at the subject calmly. Was it possible to have stone that would resist the effects of our changeable climate? He believed not. Was the magnesian limestone the best for the highly decorated style of architecture selected? He thought it was, under all circumstances. Some portions of the stone were defective, and he was only surprised from the observations made last week by Mr. C. H. Smith that it was not worse. With all its disadvantages, they need not apprehend any immediate danger to the stability of the building: it would stand after we and our grandchildren had departed this life. He went to the Houses last Monday, and saw a number of men brushing down the loose portions of the stone,—others using a kind of paint, which

will look better for a short time; but when looking at a Court, done a few months since, he saw a man busy brushing off a kind of efflorescence: that ought not to be so, if the process was considered to be effectual. Were we likely to benefit—should any new building like the New Government Offices, or a permanent Crystal Palace—from our experience of the Houses of Parliament, Buckingham Palace, British Museum, or other buildings? He feared not. He felt certain that many valuable, and, in some cases, better materials are lying useless in the rocks for the want of the engineer, architect, or proprietor making their qualities known. At the time the Druidical monuments were erected, the ancient Britons had neither roads, canals, nor railways. In the British Isles we have about 9,000 miles of rails, which give the moderns a very superior advantage, and they had also the opportunity of examining the fine old castles, cathedrals, and other works in this and other countries. The speaker then referred to the compact sandstones of the Coal Measures: limestone of the mountain limestone, syenite of Mount Soral, near Leicester, and the stone on the Malvern Hills.

Mr. Daines begged to read a certificate from Sir C. Barry, which certificate he stated had brought about all the discussion which had taken place during the last four years.

Old Palace Yard, 24th July, 1856.

Sir,

I have carefully examined the three portions of the external masonry of the New Palace at Westminster, which were covered with your Stone Preservative Solution about two years since, and I have the pleasure to inform you that I have reason to be perfectly satisfied with the efficiency of the Solution with reference to the object of its application. It seems to have checked all efflorescence arising from exudation from within the body of the stone, and all vegetation on the surface due to atmospheric influences. The absorbent properties of the stone, which are mainly the cause of all decomposition in that material, are, to a considerable extent, obviated by the indurated coating on its surface produced by your Solution, which is so hard as not to yield freely to the stroke of a chisel, and even to be capable, to a certain extent, of bearing a polish. In those portions of the stone where symptoms of decay existed at the time of the application of your Solution, no signs whatever of decomposition now appear, nor indeed in any other portion of the surface of the stone subjected to your process. Where, in one instance, your Solution was applied to stone which had long been exposed to the atmosphere, and had acquired a considerable amount of its filth and impurities, a dark and disagreeable colour is the consequence; but where, as in the other instances, it was applied to newly-faced stonework, or such as was not in a filthy state, the colour is by no means objectionable.

I am, Sir, Yours faithfully,

Mr. Daines. (Signed) CHARLES BARRY.

This (which was addressed to him) he received from Sir C. Barry on the 24th July, 1856, after two years' trial of his process. He denied that sulphur boiled with oil produced a sticky substance; and read a statement in reference to his process. This was not only his own opinion, but it was that of chemists generally, as might be seen by Brande's Manual of Chemistry. His mixture was a decided foe to vegetation, and had destroyed the moss accumulating on the parapets of the Houses of Parliament.

Mr. Jennings thought the use of gum had been hardly sufficiently considered in the discussion. The soap and alum process was something similar to the introduction of a gum. He had found the soap and alum process successful for some years in churches in Kent and Suffolk, but it did not appear to be very permanent. The diamond cement was another species of gum, which amongst others might have been noticed in connection with this subject.

Mr. Penrose said that after Dr. Hofmann's remarks the question must be undecided till the silicic ether had been tried; but as this would probably be very expensive, there was room for the employment of the cheaper processes. Mr. Szerelmey had been introduced to him with high praise by Sir C. Barry when he (Mr. Penrose) was seeking for a good kind of paint for the iron work of the exterior of St. Paul's Cathedral; and it appeared that Sir C. Barry, being unable to cover the galvanized iron roofs of the Houses of Parliament with any other satisfactory material, had adopted Mr. Szerelmey's granitic paint, which had there proved wonderfully permanent. He had not himself

used Mr. Szerelmey's process in preserving stone, but he had employed it to prevent water penetrating brick-work,—assisting it with a slight wash of resin or ordinary varnish. This had kept the water out for a year, which, although not a sufficient trial, proved the non-absorbent character of the process. He had also applied it successfully to an exposed compo front in Kent, which was no better than ordinary mortar as to resisting moisture. Again, he had applied it as a wash inside St. Paul's to give colour where there had hitherto been common stone colour. He had tried the effect of smoking with a lighted candle stone painted upon with oil colour, and stone prepared by Mr. Szerelmey's process. From the former the smoke could not afterwards be removed, whereas every trace of it was cleaned off from the latter with ease. He hoped the proposed Commission would arrive at a satisfactory result, and thought Mr. Szerelmey had shown sufficient to claim serious attention for his process.

Mr. Couch exhibited and briefly explained some specimens of stone with a glassy surface on a more friable material.

Mr. Godwin, in order to get to something definite, moved, "That the Council be requested to memorialize Her Majesty's Government, urging that a joint committee of architects, engineers, geologists, chemists, or other competent persons, be appointed to inquire into the various proposed modes of preserving stone from decay, with special reference to the present condition, causes, and extent of decay, of the stones of the Houses of Parliament; and that in the meanwhile no further large application of washes to the exterior of the building be permitted."

Interesting as the discussion had been, they had not heard anything which would lead them to put implicit faith in either of the processes. He should be sorry to see the remainder of the Houses of Parliament debased to the extent to which some portions already had been, and he therefore dwelt emphatically on the necessity of suspending further proceedings. The lucid statement of Mr. Edward Barry would have the effect of freeing Sir C. Barry from any individual responsibility in respect of the selection of the stone. It must have come home to every one of them; for no architect, let his opinion be what it might, would put forward that opinion against the opinions of the gentleman with whom he had been associated. He fully agreed with Mr. Barry and Mr. Ferrey that a great deal more had been made of the decay in the Houses of Parliament than would have been the case if there had not been three or four gentlemen, each anxious to bring forward his own particular process. With regard to Mr. Daines, he felt obliged to reiterate that, after the application of that gentleman's process to the statue of Captain Coram, the parts referred to fell off. He had seen them himself, and on applying to Mr. Marshall, after the certificate of 1856, he said decidedly, and in a very few words, that it was a distinct failure. He felt satisfied that the best course they could take would be to find out the processes which were useless, and get rid of them altogether, so as to clear the way for the investigation of those which remained.

The Chairman read a letter from Sir Henry de la Beche and Mr. C. H. Smith to the Chief Commissioner of Works, dated August, 1843, confirming in every particular the statement of Mr. E. Barry respecting the circumstances under which the Anston stone was selected, and distinctly taking upon themselves that selection.

REPORT, &c.

Museum of Economic Geology, Craig's Court.
28th August, 1843

My Lord and Gentlemen,

In conformity with the instructions contained in your communication respecting an examination of the stone employed in the New Houses of Parliament, we visited the buildings now in progress, in company with Mr. Barry, and after due inspection of them, and of the stone upon the wharf, we have to report that the quality of the stone hitherto employed and looking at the subject generally, appears to us very satisfactory, and that we found the supply at the wharf ample.

With respect to the localities whence the stone has been supplied, we would wish to observe, that the magnesian limestone or dolomite of Bolsover Moor, having been found to occur in such a manner as not to afford stone of the required sizes,

investigations were undertaken, and stone from other localities in that neighbourhood, but of the same kind, and of about the same quality, was obtained, being a magnesian limestone or dolomite. and comprised in the same range of rocks; and that finally, quarries were opened at North Anston, between Rotherham and Worksop, it being considered that the magnesian limestone or dolomite of that locality would afford both an abundant supply, and of the required quality.

Agreeably to the further instructions in your letter, it being inconvenient for Mr. Barry at that time, from very pressing engagements, to visit Anston, we proceeded to that place in company with Mr. Allen, in the employ of Messrs. Grissell and Peto at the new Houses of Parliament, and who was capable of affording us much necessary information.

Before visiting the quarries, we inspected Anston Church, and observed with satisfaction that the old tower and spire, apparently constructed with magnesian limestone of the vicinity, in the fifteenth century, were in good condition, though well exposed to atmospheric influences.

The quarries are situated on the escarpment of the hill at North Anston, and are the property of the Duke of Leeds, under whom they are worked by Messrs. Grissell and Peto, who pay to the duke a royalty of 1½d. per cubic foot, or 14 cubic feet being considered a ton, 1s. 9d. per ton.

As sometimes happens in this range of magnesian limestone or dolomite, the stone varies much in character, the bedded structure here and there disappearing, and one more massive arising; in the latter case the arrangement of the parts being so coarse, and structure so hard, that the stone is unfit for the better kind of buildings. From this circumstance, bosses or tors of hard rock project from several parts of Anston Hills, so that the stone proper for such decorated edifices as the new Houses of Parliament is only to be obtained where these bosses of hard rock may not interfere with the working of the stone possessing the necessary qualities.

The present quarries are thus situated, and out of the magnesian limestone, as it there occurs, eight beds are selected: of these the uppermost is the thickest, and affords blocks of considerable size, employed in the new Houses of Parliament, where the largest are required for sculpture or otherwise; these eight beds, as a whole, are nearly level, having scarcely any appreciable inclination; they all vary in thickness, the upper one being most uniform in this particular; the estimated average thickness may be taken at about fifteen feet, in some places the total depth being seventeen feet.

The natural vertical joints being rare, the blocks are obtained from the beds by driving wedges along the lines considered to divide the beds up in the most effective and convenient manner, so that blocks of very varied sizes can be found. We found the quarries well and effectively worked, a large mass of stone being rejected as being unfit to be sent to London; a proof of the care necessary in selecting this material for building purposes. An average of about 400 tons of selected stone is obtained per month, or about 4800 tons per annum.

With respect to transport to London, the stone is carted two miles from the Anston quarries to the Dog-kennel Wharf, on the Chesterfield Canal, and thence passes by the canal to Stockwith, where it is shipped for London.

We found the quality of this stone to be nearly the same in the different beds, and though not exactly the same as that of Bolsover, to be a somewhat close approximation to it. Being desirous of seeing how far they might chemically differ from each other, and from the Bolsover dolomite, formerly examined, we forwarded specimens of the eight beds to the Museum of Economic Geology, and three of these, namely, from the uppermost, the fourth, and the lowest or eighth bed, were subjected by Mr. Richard Phillips, F.R.S., to analysis at the laboratory of that establishment, and the following are the results:—

	Upper bed.	Fourth bed.	Lower or eighth bed.
Carbonate of lime	52.0	52.5	52.8
Carbonate of magnesia	45.2	44.7	44.4
Oxide of iron and earthy matter . . .	2.0	2.1	2.1
Moisture	0.8	0.7	0.7
	100.0	100.0	100.0

It will be observed from these analyses that, as regards chemical composition, these beds may be considered as identical; and we have no reason to suppose that in this respect the other beds differ from them. We also consider, from careful examination, that the arrangement of the particles of which they are composed is nearly the same in those portions which are selected for use: as a matter of course, the amount of cohesion of the minute crystals of the carbonate of lime and magnesia, forming the chief mass of the stone, being of the utmost importance.

In conclusion, we consider that if due care be taken, as appears to have been hitherto done, in the selection of the Anston dolomite, it is a fit material for the purpose for which it is employed in the new Houses of Parliament, and from our inspection of the locality whence it is obtained, we see no reason to suppose that an ample supply may not be obtained from thence.

We have the honour to be,

My Lord and Gentlemen,

Your very humble and obedient servants,

(Signed) H. T. DE LA BECHE,

CHARLES H. SMITH.

Mr. Tite, after promising that he hoped the discussion of this question would be of the greatest possible use, both in a public and a private sense, and that he believed they had all learnt something by it, proceeded to illustrate the effect of a solution of silicate of soda in hardening chalk, as mentioned by Dr. Hofman; and showed by experiment that it hardened even a sponge in the same way. But, as he proceeded to show, these specimens were at once softened again by being immersed in water. He also showed a specimen of sand rendered as massy and hard as flint by silicication; but which dissolved on being put into water. But when these substances underwent the second process they could be dipped in water without becoming soft. He quite agreed with Mr. Godwin that the modesty and ability with which Mr. E. Barry had addressed the meeting were most honourable to him. His defence of his father was perfectly natural, and he must be permitted to say entirely successful. With regard to the selection of the stone a degree of scientific acumen had been brought to bear which no architect would struggle with for a moment; and no architect could have anticipated the result which had followed. He did not think that any chemist examining the specimens of the stones used in the Houses of Parliament could tell why one decayed more than another. He did not wish to exaggerate the extent of the decay, but it did exist; it was a national misfortune; and Sir C. Barry appreciated the failure; for it was a mistake to say that it was not a most unfortunate failure, and he believed that it was still going on very extensively. This did not apply to the whole building, much of it being of a crystalline character, and almost indestructible. His attention had been first called to the decay by noticing the delicate and beautifully carved arch of entrance to St. Stephen's Hall, where the thin rib of stone seemed to be almost melting away. He, however, only thought of it as a matter of regret, and when the discussion arose in the House of Commons he took no part in it, until, with the sanction of Sir C. Barry, a vote was asked for £7000. to be spent in "painting," as he considered it, the outside of the building. The question then occurred to him, "What is being done with this money?" and on examining the Parliamentary Papers he found the charge was to be at the rate of one shilling a yard for plain surfaces. He could not understand that, except upon the hypothesis that some extraordinary secret material, of the greatest possible value, was employed. So stood the question when Parliament rose, and on his return to town, his attention was attracted by the interior courts, nearly the whole of which had been coated by this rubbish, as in his judgment he must call it. He found the Speaker's Court in a state of extraordinary decay, and was very glad to learn from Mr. Barry that he had stopped a process which was really only painting. His sense of smell was not likely to deceive him, and he believed they were applying nothing but common linseed oil. On observing this he thought it was quite necessary that the matter should be looked into scientifically, and when he got the Patents, which he had read, and the extraordinary pamphlet which most of them had seen, he felt that thousands of pounds should not be spent until the matter was thoroughly looked into. He had only used one process, the alum and soap,—in respect to the utility of which he might quote Abernethy's advice of *whistling* as a cure for *gôitre;* believing himself that after a very few years, *whistling* would be as effectual to prevent decay as the alum and soap mixture. He had seen a house, for coating which Mr. Szerelmey had received a large sum of money, and that was failing and being painted in consequence. He could only be guided by the evidence of his senses, and by what he really knew of the matter; and with every desire to pay due attention to his claims as a foreigner, he was not desirous to see the public money wasted, or a fine building exposed to the accidents which might attend such a process. With regard to Mr. Tennant's remarks, the Cragleith was a very intractable stone, much harder than Portland, and the price of working it was greater. And here he must repeat his regret for the misfortune which led Sir C. Barry, although no blame attached to him, to look for something better than Portland. Then again he (Mr. Tite)

had used the sandstones of Edinburgh, and the new red sandstone; and they were all bad and decomposed very rapidly by disintegration. Cragleith stone was another thing, but it was very costly. There were stones to be got of the finest possible character, such as the grits connected with the coal measures. The Darley Dale stone was of excellent quality but not adapted to gothic work. The Birmingham Railway Station by Mr. Hardwick was a beautiful and almost indestructible specimen of this. Architects did use the granites and sienites, but they were intractable and costly, and their colour objectionable, for very ornamental purposes. As he understood, it was entirely agreed that no process should continue to be used till the question had been inquired into, he thought Mr. Godwin might omit the latter part of his motion. The proposal for a Committee of the Institute was made by Mr. Sydney Smirke, but he agreed that the Institute had not the means of thoroughly pursuing an enquiry of such importance; and he therefore seconded the motion, with the omission of the last paragraph. His purpose thus far had been answered by throwing a little daylight on a very dark and difficult subject.

Mr. Godwin thought it would be better to retain the whole of the resolution.

Mr. Tite ultimately concurred.

The Chairman congratulated the meeting on the great interest of the discussion, and expressed the obligations of the Institute to the scientific gentlemen, especially Professor Ansted and Dr. Hofmann, who had so ably explained the points which architects could scarcely be expected to be fully acquainted with. After what the meeting had heard he would not himself offer any observations on the questions at issue, but with reference to the gentlemen whose processes had been discussed, he felt that if they or any persons on their behalf had held up particular processes in terms of eulogy as impeccable, they would have suffered more than they could have done from the most caustic of the slightly caustic remarks which had been made by some of the speakers. Believing that "magna est veritas et prevalebit" they might rest quite assured that time would develope all those processes which were excellent, and destroy (as it did bad stones) all those which were imperfect.

Some conversation ensued as to the wording of the resolution with reference to the scope of the proposed inquiry; and it was agreed that the words should be, "with special reference to the present condition, causes, and extent of decay of the stone."

The motion was then put and carried unanimously.

REPORT upon the merits of Daines' Patented Process, for Vulcanizing and Preserving Stonework, as Tested during the last Six Years, over from 1500 to 2000 Yards at the New Palace at Westminster, by Messrs, Sydney Smirke, George Gilbert Scott, Arthur Ashpitel, Edmund Woodthorpe, Architects, James Ruttledge, M.D., Edward Mackmurdo, Firm of Davy, Mackmurdo, and Co, Chemists, attended by intelligent practical Master Masons, &c. &c. &c.

On June 22nd we examined the specimens of stone work to which Mr. Daines has applied his process at the Houses of Parliament, amounting altogether to from 1500 to 2000 superficial yards, viz.:

1. One bay on the upper floor west front.
2. In the court yard called the Commons' Inner Court.
3. Ditto ditto Peers' Inner Court.
4. One bay on the parapet at the East front.
5. Ditto at level of terrace, East front.

No. 1.

We were informed that the Solution had been applied in the year 1854, shortly after the execution of the masonry, and when it was quite clean; we found the stone in good condition and without any indications of decay. We examined an

adjoining bay having the same aspect, and built at the same time, but which had not been prepared. We found this bay in some parts decaying, although not generally in bad condition.

The process has produced no discoloration whatever; on the contrary, the colour of the prepared parts is somewhat more uniform, and cleaner than the adjacent work.

No. 2.

The parapets, down to the top of cornice, on all four sides, were prepared by Daines' Process in 1854, as we are told. Some portions of the masonry had begun to decay at that time. No further decay appears to have taken place. Where the surface had been roughened by decay, the Solution has arrested the progress of the decay, and the roughness appears to remain as at the time the Solution was applied. At the back of the parapet of the lower buildings we observed one stone in a decaying state that had been operated on by Mr. Daines. The Clerk of the Stores, Staynor, informed us that he had ascertained this stone to be thoroughly rotten, and therefore quite unable to be by any process preserved; indeed we were told that since the Solution was used, the decaying surface had been chiselled off by direction of Sir C. Barry, but it is still in a crumbling state, and should certainly be cut out altogether.

On three sides of the court the prepared masonry is darker in colour than the rest of the work; on the fourth side it appears to have bleached to nearly the colour of the unprepared work; this side is most exposed to the weather. We were informed by Mr. Daines that in this court the Solution had been laid on, at Sir Charles Barry's desire, without previously cleaning the surface; the soot was therefore mixed up with the Solution, and occasioned this discoloration.

No. 3.

The parapet on one side only in this court has been experimented upon, the other three sides remaining untouched. The Solution was said to have been laid on in 1856. At that period the ashlared surfaces, and parts of the moulded work on all four sides had begun to suffer deplorably; on three of these sides the decay continues to extend very seriously; but on the fourth (the prepared) side, we found the surface that had been so corroded when the process was applied, remaining quite hard. This case is the most strongly marked, and the most satisfactory of any we observed; the prepared and unprepared parts being brought in close juxta-position, and presenting very different appearances; the colour of the prepared parts being brighter, and the disintegration completely stopped.

Nos. 4 and 5.

The process in these cases had been applied as we were told, chiefly in 1854, after cleansing the surface, Considerable decay had taken place at this time.

The process has arrested it effectually. Except in one or two trifling and doubtful places we found the surfaces hard sand uninjured.

At No. 4 the colour of the prepared parts is unsatisfactory, being much darkened. We were informed that in executing this experiment, the American potash used in cleaning the surface had been mixed in new oak pails which had probably caused this discoloration.

In making the examination of the above mentioned experiments we used the chisel, and subjected also fragments of the stone to heat; except in two or three doubtful stones the surface proved to have been hardened to a remarkable extent by the application. The effect of the process seems to extend generally to the depth of about a quarter of an inch. The parts that had been operated upon gave out a strong smell of oil when heat was applied.

The annexed Report shows that the sulphur held in solution had entered into the substance of the stone.

The result of our examination is, that we are satisfied that Mr. Daines' Process has generally prevented decay for six years; how much longer it may continue to act as a preservative we have no means of knowing, nor would we venture to surmise.

We are further of opinion that when the masonry is clean on the face at the time when the process is applied, and when due care is taken in carrying out the Process, no very sensible change of colour takes place.

We enclose herewith a Memorandum relative to various specimens of stone which have been experimented upon by Mr. Daines, and carefully examined by us.

(Signed) SYDNEY SMIRKE,
GEORGE GILBERT SCOTT,
ARTHUR ASHPITEL,
EDMUND WOODTHORPE,
JAMES RUTTLEDGE,
EDWARD MACKMURDO.

MEMORANDUM OF EXAMINATION OF SPECIMENS.

June 27th, 1860.

No. 1.—Specimen of ANSTON STONE, stated to have been prepared in 1854 by Mr. Daines with three coats of Solution, and kept by Mr. Parkin, at No. 29, Argyll Street, exposed to the weather under the drip of a coping, and now broken by us and examined.

After dipping in water found to be repellant of the same for nearly a quarter of an inch, which had been shown by the colour of the stone to have been the depth to which the Solution had penetrated. The side of this Specimen (an old sawn surface), prepared with the Solution, we found to be perfectly free from decay.

No. 2.—Specimen of ANSTON STONE, prepared in 1856 by Mr. Daines by laying its surface in the Solution one-sixteenth of an inch deep for twenty-four hours. This Specimen had absorbed the Solution to the depth of seven-sixteenths of an inch, to which depth the Stone appeared to have become in great degree repellant of water.

No. 3.—ANSTON STONE, half an inch thick, had absorbed the Solution through its whole thickness in four hours, exposed similarly to Nos. 1 and 2, with similar results.

No. 4.—Similar in all respects to No. 3, but the absorption had not taken place through more than half its depth. The portion which had been saturated repelled water more than the unprepared part; the two last experiments made to show the different absorbence of varieties in the quality of the same Stone.

No. 5.—Specimen of CAEN STONE prepared in 1856 by immersion as No. 2, has absorbed the Solution fully five-eighths of an inch deep. The part prepared was repellant of water, and was found very much harder than the unprepared part, which was very much decayed on the surface.

No. 6.—CAEN STONE, quarter of an inch thick, fully saturated with the Solution, was found to be very hard.

No. 7.—CAEN STONE prepared in 1856 by lying in the Solution, in the same way as No. 2, for about thirty hours; the Solution is absorbed to the depth of bare five-eighths of an inch. The unprepared side is very decayed, the prepared side is quite sound, found to be more repellant of water.

No. 8.—BATH STONE (referred to in Mr. Cundy's letter of September 18, 1856), prepared with five coats of the Solution, exposed like the above Specimen, has absorbed bare half an inch in depth, was found repellant of water, and very hard where prepared.

No. 9.—SANDSTONE from Tunbridge Wells, prepared with five coats of the Solution. The prepared surface considerably harder and more repellant; depth of absorption not ascertainable with exactness.

No. 10.—Same as No. 9, and appearances similar.

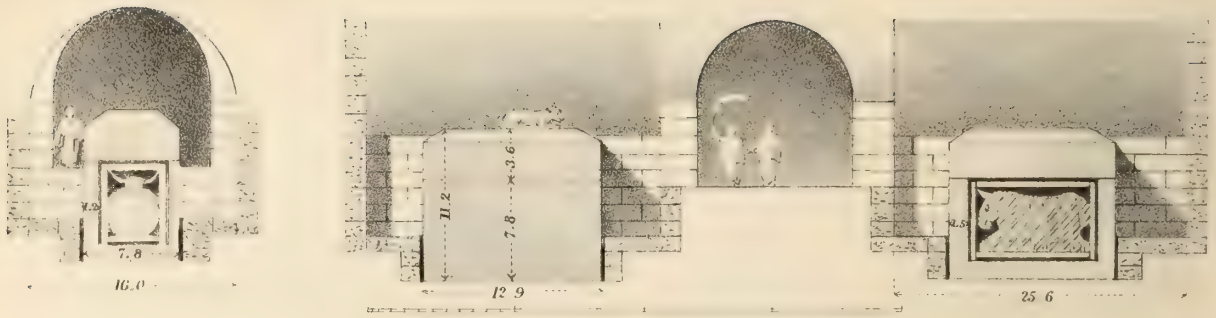
No. 11.—PARIAN CEMENT. The prepared side much harder and more repellant of water; the Solution has been absorbed to the depth of about one-eighth of an inch; had been prepared by five coats.

At a subsequent meeting of the Institute, 4th of March, 1861,

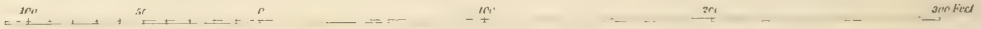
The Chairman, G. GODWIN, V.P., F.R.S., said he had to state that a deputation, consisting of five or six members of the council and two of the vice-presidents, had waited upon the Right Hon. W. Cowper, Chief Commissioner of Her Majesty's Works, to lay before him the resolution passed by the Institute in respect of the decay of the stone in the new Houses of Parliament. Mr. Tite, as a member of Parliament, introduced the deputation, and stated the views which the Institute held on the subject. He was followed by some members of the Council; after which Mr. Cowper expressed his views at some length, assenting to the opinions expressed by the Institute in both respects, although he did not appear to be quite certain that good would result from the issuing of a commission; inclining rather to the impression that more advantage might accrue from the attention of inventors being called to the subject. He seemed to agree with those who thought that the right invention for preserving stone was still to be found, and that the discussion which had lately taken place on the subject would lead chemists and others to look into the matter, and perhaps to introduce something other than had yet been tried. Mr. Cowper also gave the deputation to understand that nothing more would be done in reference to stone preserving processes at the new Houses of Parliament before inquiry, beyond completing a contract which had been entered into with Mr. Szerelmey, for applying his process to some of the inner courts. The Council, however, would not lose sight of the subject, but would report any steps which might be taken by Her Majesty's Government, or others, in reference to the matter.

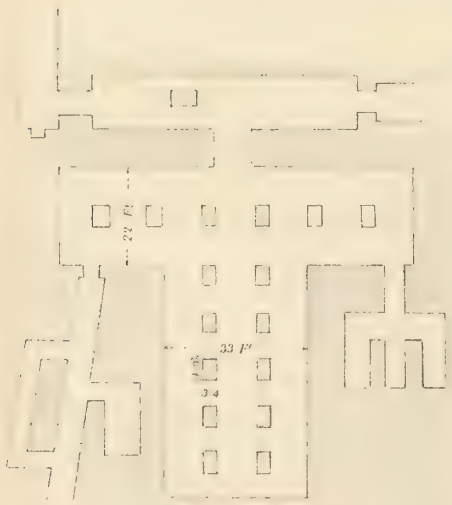
On the motion of Mr. PAPWORTH a vote of thanks to Mr. TITE for bringing the subject forward was carried unanimously and acknowledged by him.

The meeting then adjourned.



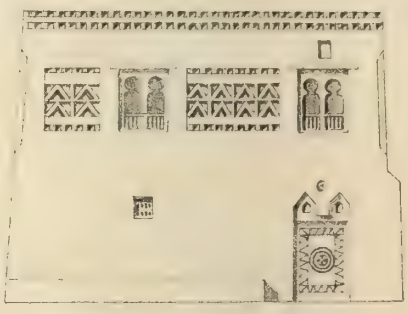
SERAPEION OF SACCARA NR MEMPHIS EXCAVATED BY MONSR MARIETTE, 1851





MONSR MARIETTE'S PIT TOMB NEAR THE GREAT SPHINX PLATFORM OF PYRAMIDS GIZEH.

CATACOMBS, RAILWAY STATION ALEXANDRIA.



ARAB HOUSES BENHA DAMIETTA BRANCH-NILE.

ARAB HOUSES BENHA DAMIETTA BRANCH-NILE.

IN THE VALLEY OF GOSHEN.

T. L. Donaldson, Del. M. I. B. A.

C. F. Kell, Lith.

Lithographed for the R. I. B. A. by Kell, Bros.

DESCRIPTION OF M. MARIETTE'S EXCAVATIONS AT GHIZEH AND SACCARA;

SOME OBSERVATIONS UPON THE DOMESTIC ARCHITECTURE OF THE ANCIENT EGYPTIANS AS EXISTING AMONG THE PRESENT ARABS;

AND

AN ACCOUNT OF CATACOMBS AT ALEXANDRIA RECENTLY DISCOVERED.

Being notes made during a recent visit by Thomas L. Donaldson, Fellow, V.P.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, February 18, 1861.

The papers were illustrated by a number of drawings and sketches, as well as diagrams on the black-board. The lecturer commenced by observing that he thought some account of a two days' excursion from Cairo to the monuments of Ghizeh and Saccara might not be uninteresting to the members of the Institute. He visited Egypt for a more serious subject than merely making architectural notes, he went upon a practical one for the Government, and, therefore, he could only employ a few days of leisure in the pleasure of visiting some of the ancient monuments of Egypt, of which he had read much, on which he had lectured much, and of which of course he had thought much. If they would allow him, therefore, he would give a brief description of a two days' journey which he had in going from Cairo to Ghizeh and Saccara. Many present who had not been in the country to which he referred might, perhaps, not be aware that the donkey was a very useful animal, and that the journeys of travellers in that country were generally made on the backs of donkeys, which were exceedingly intelligent and docile, and took great care of their burden. They went about the pace of five miles an hour, and he had been in the saddle on a donkey's back for ten hours a day, without experiencing any very great fatigue: indeed he should have experienced more had he been on horseback that length of time. It was astonishing how a donkey carried so easily a man of his weight and it was delightful to see the pleasure the animal expressed in his own way on arriving at Cairo after a somewhat long journey. Sometimes travellers availed themselves of the aid of dromedaries, and he knew a gentleman who was educated at the Roman Catholic College in Lancashire, who went into the desert with a dromedary possessed of only a few dates, in pursuit of botanical and other scientific studies. On leaving Cairo travellers took their donkey drivers and dragoman, and off they started from modern to old Cairo, which was situated at the distance of about a league. He was in the country in the month of December, and it was then as fine as the early summer in England. The traveller went through old Cairo, dismounted, got to the place for embarcation, went into the boat and crossed the Nile to Ghizeh, passing the Nilometer, indicating whether the Nile rose to a certain height at a particular time, which had great effect upon the prospects of the harvest of the country. Near the Nilometer were some monuments of very great interest; the traveller passed over the river, and got to Ghizeh, from which was derived the name of the pyramids in the neighbourhood. Having crossed the Nile the traveller got out of the boat or barge, again mounted his donkey, passed through various Arab villages, and through groves of date trees. All the while, after getting to old Cairo, the traveller saw the pyramids before him, and as he advanced they developed themselves gradually, over-topping all other subjects. The traveller passed through fields and through groves of date trees, and then arrived at the plateau of the rising bank of

the rock on which rose the three great pyramids of Ghizeh. (The lecturer then referred to and explained a number of sketches he made on the spot, representing the appearance of the pyramids from a variety of points of view). The pyramids rose up above every other object near, and for twenty-five miles approaching from Alexandria towards Cairo they were always seen. The first moment he saw the pyramids it seemed to realise the whole history of a past time, and to form an epoch in one's life. They could easily imagine the emotions that arose in the bosom when first a traveller saw the pyramids. As the plateau of the pyramids was approached it was found that the villages were distributed to the right and left. As the traveller got close to the nearest village, or even before, the Arabs came to him offering to be his guides, and of course he had likewise his dragoman along with him. And he does not grudge the money he pays (sometimes too much) to the guides who soon haul him up to the top of the great pyramid. (He then referred to some drawings, illustrating some of the scenes he witnessed). The great pyramid, as most of them might be aware, was built on the solid rock. The Professor then proceeded with his account of the

Excavations at Ghizeh and Saccara.—M. Mariette, so well known for his researches among the antiquities of Egypt, has, for some years, conducted excavations for his Excellency Said Pasha, the Viceroy, and has had the control of all the antiquities of this country. No diggings are allowed without a permission granted through him. None of the fellahs can sell the smallest object, under pain of a severe punishment, extending it is said by the Bedouin Arabs themselves to death, if any article be offered for sale without having been first brought to him to buy it, if he choose, for the Pasha's collection. He is now carrying on excavations at the Ghizeh platform, Saccara and Thebes, where gangs of Arabs are at work, under the direction of their sheikhs, with the slightest tool, and even with their hands, casting the sand, the dirt, and rubbish, into small baskets, carrying it out of the trench and depositing it at a short distance, clear of the spot. This is a forced labour; each village in turn being obliged, as for other public works, to furnish and maintain its contingent without remuneration from the Government. I observed that there were few grown-up people, the mass consisting of young boys and girls, who appeared very merry at their work, one or two of them singing a kind of couplet, constantly repeating the same words, the rest joining in chorus at the end.

M. Mariette is very stringent with respect to any strangers taking memoranda, sketches, or dimensions, and it was as it were only by stealth, and as though I were doing something else, to avoid observation, that I could put together a few notes of what I saw. In the illustrations, therefore, that accompany my remarks, these difficulties must be borne in mind, and except when I give positive dimensions, very precise accuracy must not be expected. It is to be regretted that M. Mariette does not supersede such imperfect data by himself giving accurate descriptions of his most important discoveries. He has full knowledge of his subject, aptitude and felicity in knowing where to direct his researches, and great success has attended his labours, for the collection in the museum at Boulak contains many objects of the highest value, particularly those found in the tombs. He ought himself to reap the full benefit and credit of his investigations. But his delays are unjust to himself and injurious to the study of Egyptian archæology, and he must not feel either displeased or surprised that a passing traveller like myself should seek to make known to his colleagues, however imperfectly, some of the discoveries brought to light from time to time, and in which all Europe feel interested.

I regret that I had not the advantage of seeing M. Mariette while I was at Cairo. I called twice upon him at Boulak. He was out both times; the first he had gone to Ghizeh with M. Lesseps, the second time he had just started on the Nile to pay a visit of inspection to the operations carrying on at Thebes.

Tomb near the Great Sphinx.—M. Mariette has for some years been engaged in excavating a tomb upon the Ghizeh Platform, within 100 yards of the Sphinx. This tomb, like that of Campbell,

is sunk in the solid rock, out of which it has been excavated 30 or 40 feet deep. It assumes very much the form of a church, with a central aisle and an aisle on each side, separated by square pillars, with a transept at one end having a central line of pillars. There is a wide door at the end, leading into a kind of vestibule, parallel with the transept, nearly as long but only half as wide. In the vestibule there is a well of considerable depth, with water in it from the Nile. At each end of this vestibule are doorways, one leading into a gallery still filled with sand, the other into a wide passage running at right angles to it, the end also blocked up with sand. I should state that the whole of these parts have no roofing now, and are open to the sky. From the transept there are openings; that on the one side leads into three cells parallel with the aisles I have just described; they are about 10 feet high, and over them was a much larger chamber. The opening from the other end of the transept leads into a narrow passage, also running parallel with the nave and side aisles, rising in an inclined direction and being apparently the passage of entrance. On one side of this passage, in the thickness of the rock between the passage and side aisle, is a chamber; on the other side of the passage an inclined passage leading to an upper story, probably over the entrance passage and the chamber last noticed. The inclined passage is lined half its height with large blocks of granite, and the other, or upper half, and the ceiling, are lined with slabs of Egyptian alabaster 12 to 15 inches thick. A specimen of this alabaster I brought away with me, and it lies on the table.

The piers dividing the nave and aisles are monoliths, 4 feet 9 inches by 3 feet 4 inches, and 14 feet high, upon which rested longitudinal beams or architraves about 3 feet high; most probably on those rested the transverse beams forming the roof or ceiling. The walls were lined with blocks of granite of different tints, some of deep red, others approaching to grey. I measured some of these as memoranda of the gigantic character of their construction, 15 feet long by 5 feet high, 11 feet long by 3 feet 6 inches by 5 feet, and others 3 feet 4 inches square on the face. The blocks in the angles had no joints there but returned on the other face, 2 or 3 inches, of course alternately breaking joint with the blocks above and below. This must necessarily have caused great waste of material and considerable additional labour. In the upper part, near the surface, I perceived some constructed walling formed of huge blocks of the rock itself, laid in regular courses. As I did not meet with M. Mariette at Cairo, I was unable to ascertain what had been found in this tomb, if any sarcophagus had been discovered, and the nature of any other particulars brought to light.

Before quitting the platform of the pyramids I will venture to mention two or three other points with which I was struck. In front of the smallest of the three great pyramids there was originally a considerable court, with a dromos or avenue which led up to it. The walls are thick, and consist of blocks of the full depth of 6 feet, and in courses 6 feet high. I measured, as the average length, blocks 16 feet 11 inches, 16 feet 9 inches, 16 feet 6 inches, and 11 feet 5 inches long.

When the bases of the pyramids were clear of the sand, debris, and blocks, which now encumber them, they must have had large platforms, the rock having been cut away to form the level. Consequently, at 100 or 150 feet behind the pyramids to the west the face of the rock gave a perpendicular height of 10 or 15 feet. In the body of the rock tombs were cut, having doorways opening upon the platform.

I found, on the lower part of the third pyramid, courses of red granite, several blocks remaining in their original position, and having the appearance of bossed blocks 3 feet 8 inches high, 3 feet 6 inches deep from front to rear on the upper bed, and from 2 feet 10 inches to 4 feet wide; they were wedge-shaped in plan, so as to form a key, and there was a curious angle-shaped channel on the face of some of the blocks lying about. The second pyramid was faced with a granite revetment in the same manner as the first.

The learned Professor exhibited specimens of alabaster, mortar, and basalt which he found in

Egypt. He next proceeded to give some account of his journey to Saccara. Departing from Ghizeh the traveller passed over the desert, with his donkey, donkey-driver, and dragoman, passed by a lake, got to a kind of mound on which was a monument, advanced onwards and found other lakes, which were frequented by wild ducks, snipes, and other fowl, which sometimes afforded good sport, and were found very convenient for supper. The traveller rose up in the desert ascent, and then he found a wild sequestered scene, having fragments of mummies and bones, and thus he passed on to the village of Saccara. The next morning he was up before daylight, had the donkey got ready, and off they proceeded to examine the monuments which he was about to describe.

Sarapeion of Memphis.—The Bedouin village of Saccara is in a direct line about a mile or a mile and a half to the west from the site of Memphis. Up above the village, on the Lybian range of hills, are several pyramids with an immense quantity of tombs, proving that this must have been the principal cemetery of ancient Memphis. The pyramids are crumbling away, still, however, retaining gigantic proportions; the numerous mounds by which they are surrounded indicate constructions beneath, or the excavations of Arabs or travellers in search of antiquities, and for miles the surface of the sands, which have accumulated to the height of tens of feet above the rocky level, are strewed with fragments of mummies, blanched bones, and other worthless fruits of the diggings of the curious, inspiring feelings of horror and disgust at the ruthless spoliations of these resting-places of the dead. Strabo mentions as at Memphis, of which this plateau must have been considered to have formed a suburb or part, "a Temple of Serapis in a spot," he says, "so sandy that the winds fill it up;" and in it he saw sphinxes embedded, some half-way, others up to the head. It would, therefore, appear that in ancient times the same agencies existed, and it could have been by constant attention alone that the areas and dromoi of the temples could have been kept free from the accumulation of sand. Monsieur Mariette had seen a dozen sphinxes at Alexandria, and many at Cairo brought from this part, and felt convinced that in this locality must exist the burial place of Apis or Serapeion alluded to by ancient authors. He was engaged in his researches four years through the sand, in many parts 80 feet deep, and discovered the dromoi or sacred avenue leading from the Serapeion of the Grecian times to that of the old Egyptian dynasties. The ceremonies connected with the god Apis were very peculiar. He was a white bull marked with black spots; great care was used in the selection of the individual animal, that he might fulfil all the conditions required by traditional usage. He was kept in his sanctuary with scrupulous devotion, and not allowed to have food of too nourishing a quality lest he should become too fat. He was occasionally, but rarely, brought out and exhibited to the worshippers. He was not allowed to live beyond twenty-five years, arriving at that period he was slain, and his successor selected. They usually died at an earlier age; one is recorded whose death occurred when he was 17 years 6 months and 5 days old. It is said that £20,000 were expended for funeral rites, which were of the most sumptuous character.

The Serapeion which I visited had its connection with the temple of Apis, and is situate on the slope of the hill about half a mile to the north of the great pyramid, and the descent to the present entrance is to the depth of some 30 feet or so below the general surface of the sand. We first passed along a narrow gallery about 45 paces long, then turned to the left some 25 paces, which led into the main gallery, 4 paces wide, and, perhaps, 15 or 18 feet high. The whole excavation is in the natural rock, which consists of a soft friable grey stone, like indurated clay, with seams of striated or fibrous alabaster, from half an inch to an inch deep, and about 12 or 15 inches apart. The roofing of this gallery is semicircular in form, but the sides up to the springing of the circle are lined with courses of soft Thorah stone, in courses 14 inches high and 18 inches thick. Turning to the right down this wide gallery, sepulchral chambers present themselves on each side. Nothing can be more imposing. In the dark gloom of the excavations, lighted only by the glimmering flare of a wax candle or two, or

by a few pieces of burning resinous wood producing a doubtful gleam, these mortuary chapels, on a lower level than the gallery, and into which the eye intently gazed to catch sight of whatever might be within, presented a gigantic sarcophagus in the centre 11 feet high, 12 feet 9 inches long, by 7 feet 8 inches wide. Such at least was the size of the one I measured, although M. Mariette records others from 15 feet to 18 feet long, and 13 feet high. These enormous proportions have a very impressive effect. They are of porphyry, grey and rose granite, and basalt. The body of the one I drew was 7 feet 8 inches high, hollowed out to receive the mummy and case, the sides and ends being left from 1 foot 2 inches to 1 foot 5 inches thick; the lid was 3 feet 1 inch high, and splayed off at the top with a level upper surface 4 feet 10½ inches wide. Each sarcophagus without the lid must have weighed 30 tons. Let us consider for a moment the labour employed to disengage such a mass from the quarry, to transport it several hundreds of miles from the upper country, to carry it from the Nile up to the level on the side of the hill, and then to convey it along the galleries, and to raise and to lower it into its permanent position. One of the sarcophagi in the rough still remains near the main entrance, as though in course of preparation for the mummy of the creature god. The floor of these lateral chambers was 3 feet 9 inches lower than that of the main gallery, and the bottom of the sarcophagus was sunk some 3 feet 6 inches below that. The chambers varied in size, and were lined with courses of Thorah stone up to the springing of the vaulted ceiling like the main gallery. One sepulchral chamber I measured was 25 feet 6 inches from front to rear, by 16 feet wide in the clear between the masonry; others measured between the rock 25 feet 8 inches by 12 feet, thus varying in size. There are only three which have hieroglyphics; those of the one I particularly examined were not deeply chased, but rather thinly incised, almost in mere lines as it were on the outside surface, and very few characters. For myself I did not find any hieroglyphics on the other sarcophagi that I examined. I saw 25 of these chambers, as shown on the plan, beyond which the galleries are encumbered by *debris;* but there are further continuations examined by M. Mariette, and I doubt not others are still concealed from view, but probably containing other like stupendous sarcophagi.

M. Mariette discovered these subterranean deposits of the dead in 1851, and found 40 chambers. One of these sepulchral chapels remained intact, just as it had been closed in the reign of Rameses II, some 3,700 years since, and containing still the statuettes, vases, and trinkets usually deposited with the bodies, but of which the other chambers had been despoiled. Many votive tablets exist, some inscribed with the names of Darius and of Cambyses, the latter of whom profanely wounded one of the sacred heifers, which, however, an inscription proves to have survived some years after that event. I found a rudely carved figure of a couchant lion in stone on one of the sarcophagi, 4 feet 8 inches long and 1 foot 10 inches high, as shown in the drawing.

On Fellah Arab Architecture in Egypt.—It will be remembered, that when Champollion and the other investigators of the hieroglyphic inscription on the famous Rosetta stone had their enquiries so materially aided by the Greek translation of the edict on that lingular slab, they had still to find the elements of a language embodied in the hieroglyphic and demotic characters, so as to afford a clue to the hidden meaning. With much ingenuity reference was made to the tongue of the people who had constantly inhabited the country, and among whom tradition might still have retained the like language. Success attended this reference to the Coptic, which was found to contain the key of the ancient Egyptian language. As I was travelling in lower Egypt, I was struck with the fact that almost all the villages are built on artificial mounds, rising from 20 to even 100 feet and more above the general flat and level of the natural soil. These mounds abound in the neighbourhood of Alexandria and Cairo, and in the Valley of the Nile, and, in fact, throughout the region of lower Egypt; consisting of accumulations of the Nile mud mixed up with

large quantities of fragments of pottery. If for any reason portions are cut through or removed, all sorts of antiquities, as for instance, bronzes, terra-cottas, scarabei, and even tombs with mummies, are occasionally found, as also sarcophagi; at length I found them to be the sites of ancient towns and villages of the remotest periods of known history, the accumulations of a succession of generations, which had had their frail tenements built one over the other, thus raising the mass still higher. They were thus more and more above the influence of the annual risings of the Nile waters, and protected from ravages that are caused thereby, and the more healthy, as they were higher above the occasional miasma arising from the vegetable decomposition, the natural result of the stagnation of the waters, until the Nile retired within the limits of its natural bed. Having to go to Raselwadi, in the Valley of Goshen, I saw the grand extensive mound of Bubastis, of high note in ancient times, and situate near Zagasik. It rose from the plains like the mounds of Nineveh, Nimrod, and other Assyrian cities described by Layard, and with which these Egyptian mounds have a remarkable analogy. I was detained for some hours on two occasions at Benha El Assol, on the Damietta branch of the Nile, close to the mound of the ancient Athorbis, where a friend of mine has found a great variety of antiquities. I was struck with the rude form of the mud-built huts and houses of the Fellah or people of the country: the walls consisted of sun-dried bricks of a dusty brown color—the faces inclined backwards like the ancient Egyptian temples—flat terraces formed the roofs, on which the Arabs stow their fuel, and perform many of their domestic operations; the apertures for light or air are of rare occurence and small, seldom appear on the outside, and are more generally next the court, to ensure privacy and shade. While I was detained at the railway station of Benha I made a point of thoroughly examining its adjoining village, and calling to mind the representations of domestic buildings which we have upon the hieroglyphs and frescoes of antique Egyptian monuments, and as given by Sir Gardner Wilkinson, Champollion, Rosselini, Lepsius, and in the work of l'Egypte, I recognised the analogy at once between ancient and modern usages, and found that the buildings, like the language of the people, are a tradition of by-gone times of remote antiquity, and that the one explained the other like the modern cottages of Lycia, which present the same features of timber construction as the tombs of Zanthus, carved 2,000 years ago. The bricks are nearly the same size as ours; they are simply made of the Nile mud by boys, who perform all the operations, assisted by girls and other boys, who carry the material to the modeller, each of whom makes 900 per diem in winter, and 1,200 in summer. They are placed with two courses of stretchers to one headers. The wider openings have timber lintels of the date-wood. To produce an ornamental appearance they lay a line of bricks herring bone fashion, so as to present a sharp edge on the face. At others every alternate header recedes from the face 2 or 3 inches. They have tile-formed bricks about 12 inches long by some 2 inches thick, to form pointed tops to small apertures, or ranged in a row to give a zig-zag appearance. Vertical channels are sometimes introduced, like those in the face of the ancient Propylea for the banner-masts, and they are formed either by receding bricks one over the other, or by vertical bricks placed edge on, one over the other. But I need not minutely enter into further details, which are so much more perspicuously shown on the drawings. Over the doorway I observed that they always had a bit of crockery, as a plate, inserted into the face of the brickwork; one of those I saw was a plate or dish with the willow pattern on it. Frequently the doors are painted in brilliant colours, especially green, red, and yellow, with white in patterns; and I should observe that at Cairo every Hadji who had been to Medina or Mecca immediately had his doorway bedizened with colour to mark the important event. The general tone of the houses and villages is a dirty mud, now and then, yet very rarely, enlivened with a little whitewash on the strings and other features. But the mosques are always white. Sometimes it is a favourite habit for the Bedouins to dip their hands in whitewash that they have prepared, and daub the surface of the wall with the marks of the five

fingers. In fact it is the custom with new married women when they have prepared the dough for a meal to dip their hands in the flour and mark the outside wall round the doorway, to show that she pays attention to her domestic duties in preparing her husband's food.

The streets of the villages are very narrow, varying from 4 or 5 to 7 or 8 feet, except, perhaps, one or two streets for the bazaar, which may be 10 feet wide. This is for the purpose of shade and keeping the streets cool, a necessary precaution in hot climates, and very prevalent in the East. The huts are only one story high, and rise 7 or 8 feet. Some houses have two stories and a court-yard, with an outer staircase leading to the upper rooms. At the village of Saccara the treads or steps of a house at which I slept consisted of blocks of Thorah stone, brought from the ruins of the adjoining tombs and pyramids, carved with hieroglyphic inscriptions on the upper face, and which were being gradually worn away. The floors and roofs are formed of rough lengths of the palm-tree wood, some 12 inches apart, covered with reeds and a thick coating of mud, which cracks easily and admits the rain whenever there is a storm; this, however, is of rare occurrence above Alexandria, though frequent enough in that town.

The Arabs pay great attention to ventilation, and have apertures expressly for this purpose over their doors and windows, and under the ceilings in other parts, and occasionally just above the floor. These apertures they close with a mat stuffed in, which they remove whenever they wish to produce circulation of air in their cabins or rooms. Their sanitary precautions extend no further, for they have no drains, and all their dwellings are very dirty and abound in fleas, not to mention other insects and vermin.

Fowls, pigeons, and doves abound in the plains and desert, where they easily find food, and there are quantities of them in every village. Conical-shaped dovecots are generally perceivable in all the towns rising above the general lines of the roofs of the dwellings; and usually the minaret of the mosque forms another vertical object in striking contrast with the flat tops of the houses. Many date trees also break the level line, as each village has them, being especially valuable as producing one of the chief articles of food, fibre for their cordage, wood for their timber framings and utensils.

As I passed along the Egyptian plains and valleys and saw these mounds one after the other, with flat-roofed buildings and of pyramid shape, I could not but feel impressed with the conviction that these modern constructions recall the features of the towns and villages of antiquity, erected on the very site of olden cities, inhabited by a like race, ruled by like laws of supreme power in their chiefs, following the like custom, but destitute of that civilisation and grandeur of conception in their priesthood and dynasties which once produced those wondrous fabrics that have employed the highest genius and most profound learning of modern times to investigate their ruins and read the hidden mysteries of their records still preserved.

The learned Professor then proceeded to say that when at Alexandria he visited Pompey's Pillar, which was of granite. The pillar rested on a block or die somewhat less than the diameter of the column itself. That was a most remarkable circumstance, and another was this, that Pompey's pillar itself was upon a mound that was he dared say 100 feet above the general level of the surrounding country. The learned Professor gave a description of the pillar, aided by drawings and diagrams on the black board. He had asked Mr. Rouse the engineer at the railway station, to make an examination as to the stability of the pillar, for it would be a great pity if such a monument were to come down, and he hoped that representations would be made to the Viceroy in favour of a thorough and proper examination being made.

Catacombs at Alexandria.—In the illustrations accompanying the "Architectural Dictionary," now in course of publication, are some plans and sections of tombs in the catacombs about three or four miles out of Alexandria to the westward. They are very curious, presenting features of the

Greek period, and are of considerable extent. Of late years Mr. Rouse, chief engineer of the railroad, has had to cut away a portion of the rock in the immediate vicinity of the station, in order to gain further space for the accommodation of the increased traffic. These operations have brought to light a vast quantity of catacombs, which were not known to exist. The upper surface varies from 20 to 60 feet (I think) above the present level, and the sides present a perfect honeycomb of tombs, one above the other, excavated in the live rock. Each family catacomb consisted of one, two, three or even four chambers, and had a distinct access from above, with its separate stairs, cut in the rock, leading down to the subterranean vaults. Each chamber had two or three tiers of columbaria, 2 feet 3 inches to 2 feet 10 inches wide, and 2 feet 10 inches high, and from 5 feet to 6 feet 6 inches deep. In some cases, as though for children they are only 1, 2, or 3 feet deep. The ceilings were cut in the form of a low arched vault, and were painted a blue colour, having a flat ovolo moulding at the springing, also painted red. I will describe the tomb, of which I give a plan and section.

The principal sepulchral chamber was 14 feet 8 inches by 18 feet 6 inches, having on the side opposite the door an arch, flanked by antæ, and a sunk receptacle for the body cut in the rock; the lid, if any once existed, is not now remaining there, though others have been found. Over this was cut at right-angles in the rock, a columbarium to receive a body, 2 feet 4 inches wide by 2 feet 8 inches high, and 7 feet 3 inches deep. At one end of this chamber there was a like arrangement without the columbarium over, and part of the back being partially broken away, and a portion of the wall in another part of this chamber, which we found to be only 6 or 9 inches thick, those apertures disclosed on the other side of the thin walls, other sepulchral chambers belonging to distinct tombs of other families. The antæ had beams over them sunk in the rock, dividing the ceiling into three compartments. The doorway leading into this chamber had on the outside three-quarter detached columns, over which was an entablature and pediment. There were considerable remains of colour, and paintings of flat Egyptian figures in panels, showing that although the architectural features were Greco-Roman, the pictorial decoration retained the character of Egyptian art. The level of the chamber is about 2 or 3 feet above the floor of that adjoining, which is 18 feet 11 inches long by 13 feet wide, also vaulted. The two sides only of the chamber are pierced for columbaria, three ranges high, five or six of a row, irregularly placed. One in the angle, 4 feet 9 inches wide, forms a species of vestibule, 16 feet 9 inches by 13 feet 8 inches, having its sarcophagus cut in the rock, and columbarium over at the back of the recess. An aperture, 8 feet 3 inches wide, led into a sepulchral chamber, which had three tiers of columbaria on the three sides, there being six in each tier on the side opposite the entrance, and space for four in a row at each end, although at present only three were cut, leaving room for future bodies to be received. Each of the openings in this chamber has narrow delicate architrave mouldings of a Pompeian character, worked in plaster, with thin consoles to support the head mouldings. I found this to be the case in other tombs. From the accumulation of *debris* and collection of water, it was impossible to ascertain precisely the height of the chambers, but they must be about 11 feet 3 inches to the springing of the vault, and the vault itself rises 2 feet 6 inches, giving a total height of about 13 feet 9 inches.

He hoped that future travellers in Egypt would examine the subjects to which he had referred, more fully than he had had an opportunity of doing, and give the Institute the benefit of such examination.

Professor Donaldson V.P., added, at the close of his observations on Egyptian matters, that passing through Marseilles, he had visited the cathedral in that city, and had brought away specimens of the marbles used in its construction.

Mr. Kerr, Fellow, inquired whether Professor Donaldson had found any zopissa on the buildings he had examined.

Professor Donaldson.—No, I did not.

Mr. Godwin, V.P., said that, in order to make their proceedings formal, he would move, what they had already signified, that a vote of thanks be accorded to Professor Donaldson, who had proved that evening that he had lost none of his old energy of character nor of his desire to serve the Institute. The narrative of his exploration of the monuments of ancient Egypt was full of subjects for reflection, and offered many points of contrast between the past and present. It occurred to him that the Serapeion, with the gigantic sarcophagi which were in its chambers, as described by Professor Donaldson, was one of the most extraordinary monuments remaining in Egypt. The account of it filled him with awe. When it was remembered what difficulty had been experienced in fashioning out of a single boulder a sarcophagus for the Duke of Wellington, the fact that here were at any rate 24, there might be 50 for what was yet known, each four or five times as large as that in St. Paul's, raised feelings of wonder and admiration for a people who could perform such great things; and then, when, on the other hand, they heard of such a people worshipping as a god a bull which they themselves fed and they themselves killed, the weakness of human nature came before us in contrast, and led to contemplations of a striking character. A dozen such reflections arose, but he would be sorry to weaken the remembrance of the vivid and graphic relation they had heard, and so would restrain himself to moving that the warm thanks of the meeting be awarded to Professor Donaldson for his interesting observations.

Mr. T. H. Lewis, Hon. Sec., said he did not quite understand Professor Donaldson to have described the form of the sarcophagi at Alexandria, and he wished to know if they were carved.

Professor Donaldson replied that they were all oblong, and that three or four of them were incised, not with hieroglyphics but with lines. They consisted of two pieces only, of granite or basalt. Several of the bulls were in them, wrapped up in the usual manner, the eyes formed of glass, and the horns wound round with ligatures. When he stated that the funeral ceremonies of some of the bulls cost as much as 20,000*l.* each, there could be no doubt that the sarcophagus cost a large portion of the sum. The difficulty and expense of working the block of stone, and conveying it several hundreds of miles from above the first cataract of the Nile, must have been enormous.

Mr. C. Barry, Fellow, in seconding the vote of thanks, observed that the paper which Professor Donaldson had read would be studied with interest by those who proposed to follow in his steps and to pursue the line of investigation which he had so successfully inaugurated.

Mr. Kerr inquired whether the sarcophagi bore the appearance of belonging to a succession of sacred animals, for, if the bulls represented a period of about twenty years each, these tombs would represent a period of nearly 500 years.

Professor Donaldson said he had failed to discover, in the dark and haste, any difference of age in the sarcophagi which he had examined. He then read an account of the Serapeion, by Mr. Birch, about to be published in the "Architectural Dictionary."

Mr. Kerr asked what was the size of the solid block of stone which supported Pompey's Pillar.

Professor Donaldson replied that it was about 7 or 8 feet square.

Mr. Kerr suggested whether it might not be a foundation stone bedded in concrete or rubble which had been removed, for one could scarcely imagine that the pillar rested on the stone alone.

Mr. Morris, Associate, suggested that the right way to appreciate the paper they had just heard read would be to treat it in the light of the narrative of a ramble in Egypt. It was a paper of surpassing interest, and the author had spared no pains to make it practical and instructive.

In reply to further questions,

Professor Donaldson said that the French architect, who had made the drawing of Pompey's Pillar exhibited in the room that evening, was of opinion that the base had been supported in the

middle of the solid block of stone described, but that trophies, consisting of armour or something of the kind, had been fixed at the corners, so as to give additional security to the pile. These, he thought, had from time to time been removed, and the boulders substituted.

Mr. Papworth, Fellow, called attention to the extraordinary difficulty which must have been experienced in getting the sarcophagi into their position. He confessed he could not comprehend how human force—for mechanical was out of the question—could be brought to bear so as to turn round and put into position, in such a place, a block of solid stone weighing sixty tons. While upon this subject he wished to ask whether the Wellington sarcophagus was a block of solid stone? for he found, on visiting the tomb of Napoleon in the Invalides, that the sarcophagus there was not of one piece of solid stone, but was formed of five pieces.

The vote of thanks having been unanimously passed,

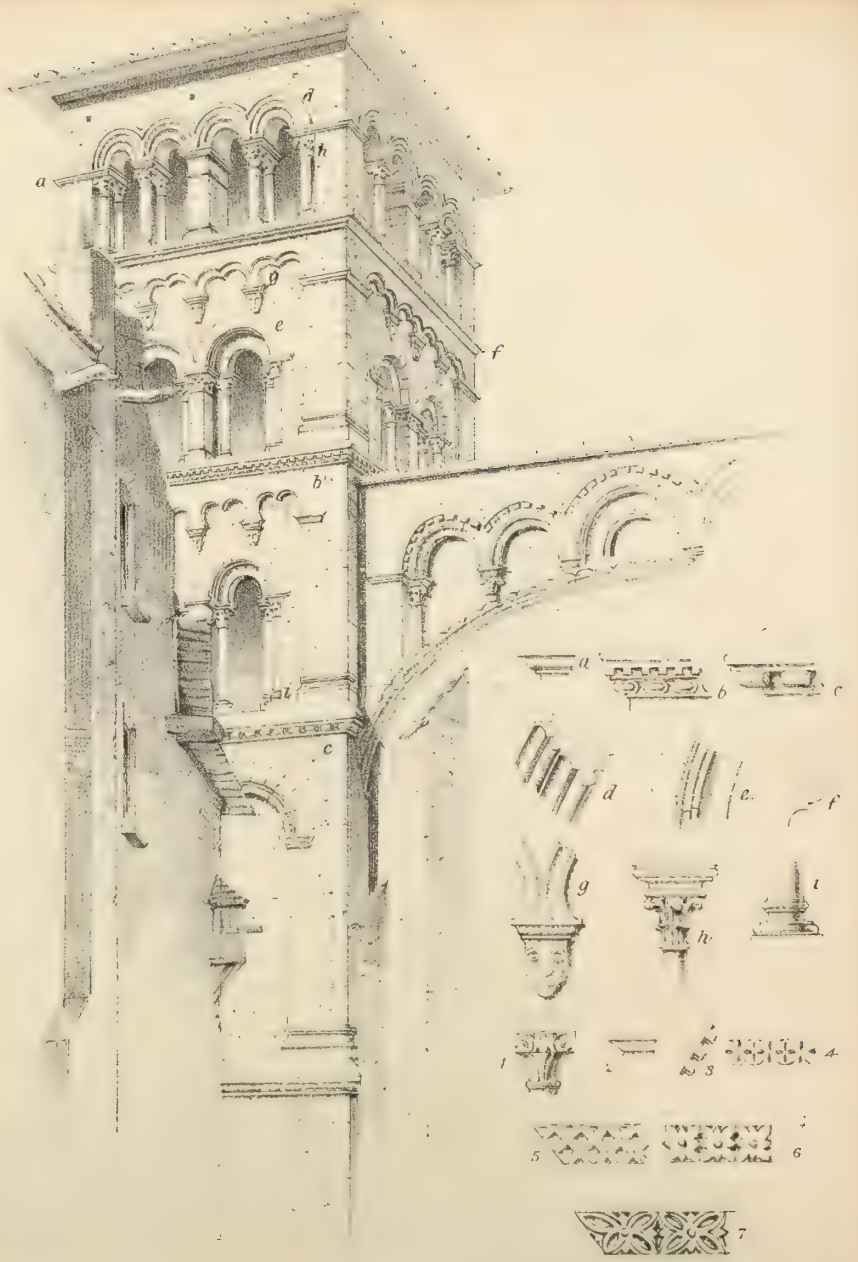
Professor Donaldson observed that a great deal had been said of late about drinking fountains, and that he wished to say a word upon those which he witnessed in the East. They were not the miserable pigmy things which met the eye in London, and which were a disgrace to art and to taste, but they were large handsome structures, composed of marble or alabaster, bold and beautiful in design, and elaborate in their enrichments. They were raised by pious Mahomedans for the public weal, and there was generally a day-school above them, from which the voices of the children could be heard above the babbling of the water. Surely we might take a lesson from the Egyptians, and raise fountains which would not be a disgrace to the country and the age. He called attention to two ancient vases which had been sent to this country by Mr. Rouse, the engineer to the railway at Alexandria. On the recent occasion when he referred to the monuments of Egypt which he had lately visited, he stated that Mr. Rouse in enlarging the railway station had come on a number of ancient catacombs. Since the reading of his paper at the Institute, Mr. Rouse had forwarded him the largest of the two urns now on the table, and, on examining it, it was found that some of the calcined bones still adhered to the inside. On calling the other day upon some members of Mr. Rouse's family he had been shown the smaller of the two urns, which was one of the most interesting specimens which had ever come under his notice. It was an original cinerary urn, or rather vase, and was full of calcined bones, the top being closed with hard clay. A small hole showed the bones. With respect to the probable dates of the urns, he believed that the larger one (about 18 inches high) was of the period about 200 years before the birth of our Saviour. It was of Greek origin, of the epoch when the Ptolemies ruled in Egypt. He had visited the British Museum with the view of refreshing his memory on the subject, and Mr. Birch had shown him a number of vases, with female figures carrying vases, precisely similar to those now on the table. The women in drawing water from the Nile used similar vases in the present day. When full they carried them on their heads, standing upright, and when empty on the side. The smaller vase was especially worthy of attention, as he believed few persons in the room had ever seen a real Greek vase full of burnt bones.

Mr. Ashpitel said that the smaller vase was quite a unique instance, as he believed no vase of the kind (pitcher shaped, with three handles) had been found used as a cinerary urn. It was also interesting in a historic point of view, as it went to prove that the Greeks sometimes burnt their dead instead of burying them. Another curious feature about it was that the vase was closed with clay, as they had generally a loose cover or no cover at all. The probable solution of the matter was, that the vase contained the bones of a Greek who had died in Egypt, and whose ashes the relatives had placed in the vase with the view of bringing them home to his friends.

Professor Donaldson said he believed that the urn contained the ashes of more than one body.

The Chairman (Mr. G. Godwin, V.P.) pointed out that as a work of art the vase was elegant both in colour and form.

TOWER OF AINAY LYON.



TOWER OF ST ANDRÉ LE BAS VIENNE.

T A Waring, Del M I B A

C F Kell Lit

NOTES ON ROMANESQUE ART IN THE SOUTH OF FRANCE.

By J. B. Waring, Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, 4th March, 1861.

Some friends have suggested to me that it would not be unwelcome if I were to give to the Institute a few notes, which I made during a late trip through France, mostly concerning matters relating to architecture; and although I am fully aware how very slight and superficial they are, still some of my brethren in art may find them of interest and of use in future days; and now that a complete line of rail joins Paris with Marseilles, Marseilles with Toulouse and Bordeaux, and thence by Angoulême and Poitiers to Paris again, such a trip becomes merely the pleasure excursion of a summer holiday. The main object of these notes will be to direct attention to the Romanesque sculpture and architecture of the South of France, as seen in some cities of Provence, Languedoc, and the adjoining districts. Leaving behind us the noble examples of Mediæval art at Sens, Dijon, and Auxerre, which last, as regards its architecture, painted glass (thirteenth and sixteenth century), and very beautiful sculpture, will repay the tediousness of a trip *en voiture;* we will make Lyons our starting point. It is true that there is not much here in the Romanesque style, but what there is is very interesting: the principal monument is the Abbey church of Ainay, a cross church, with an entrance tower, and a lower tower over the dome: parts of this building, including the entrance tower, have been ascribed to the Carlovingian period. Experience has led me to be very diffident as to assigning dates, without very good authority; and although parts may be of an earlier epoch, the entrance tower may, I think, be safely assigned to the early part of the eleventh century. The entrance is by a pointed arch, with details of a more decidedly Roman character than can be found elsewhere in the work, and is possibly an insertion at a later period; the rest of the building is plain and massive; the internal archivolts are not moulded; and the dome, which rests on angle squinches, is supported by antique columns, cut in half, to which the other columns of the nave are roughly assimilated. Like other ancient monuments in France it is undergoing complete restoration. The insertion of red tiles, as an ornamental feature, so remarkable on the tower, is to be seen again on the façade of the bishop's palace, a portion of which (now blocked up), still remains; and as this corresponds with similar Romanesque arcades of domestic architecture in France, all very much of the same class, we may take the approximate date above given as by no means too early. The sort of acroteria to be seen at the angles of the tower have been supposed to indicate a very early date, but that this is no certain criterion may be judged from the fact that they occur also on the tower of St. Radegonde at Poitiers, which may be ascribed to the latter part of the eleventh or the beginning of the twelfth century.

Of the old church of St. Pierre, only the portal remains in its original state; well designed and massive, it appears to be a work of the eleventh century, and exhibits the large cusping so frequently seen on the Romanesque churches of the Rhine and of central France. St. Pauls still retains a good octagonal belfry and apse of this style. It is needless to dilate on the cathedral, and on other well-known Pointed buildings of this city; but I would add that no one should fail to visit the Museum, which has been lately enriched by a most interesting collection of works in ivory, enamel, metal, &c., bequeathed by M. Lambert: amongst which the statuette, in ivory, of the Virgin, seated, and holding

the infant Saviour, in a vesica piscis on the lap, is pre-eminently remarkable; it is solid, about 14 inches high, and opens so as to form a triptych, containing panels, with a central crucifixion and subjects from the life of the Saviour, in relief. A similar portable statute of the Virgin is preserved in the Museum of the Louvre, and given in Le Duc's "Dictionary of Furniture," p. 132, but that of Lyons appears to be of somewhat earlier date, and may be ascribed to the end of the twelfth century. From Lyons to Avignon, following the course of the Rhine, there is little that bears on Romanesque art. At Vienne, the towers of St. André-le-Bas, and the desecrated church of St. Pierre, are good examples of their class. Amongst the few old bits left in the cathedral I would draw notice to the external arcade on the north side; to a curious pilaster (from the interior), which is remarkable as exhibiting angular hollows, formerly filled in, no doubt, with coloured substances, of the same character as seen on Childeric's sword-sheath at the Louvre; on the lately-discovered Spanish offertory crowns at the Hôtel Cluny; and on the Anglo-Saxon brooches, &c.; to (also in the interior) a very curious frieze formed by the signs of the zodiac; and to some very rough and mutilated statues in the lateral porch (north), pleasing to antiquarian eyes. I would not leave Vienne without asking attention to the large cuspings of the tower of St. Pierre, similar in character to those on the portal of St. Pierre, at Lyons, just mentioned, and so usual in Auvergne; for it is the last time we shall find them on our way south; and this leads me to remark that I do not think, as Mr. Street suggested in his late lecture, that any influence came from the south into Auvergne; but, on the contrary, that the French archæologists are right in making Auvergne one of the great centres of Romanesque art, the waves of which decreasing in power as they spread in circumference, died away about this point in a southern direction. The cathedral at Valence is undergoing complete restoration, and its curious porch is closed to the public; the interior, however, and the apse with its chapels, appear to belong to the early part of the eleventh century. Everything here is plain and massive; and the choir, with its stilted arcade, has a peculiarly Hispano-Moresque character, though I believe this arises only from constructional necessities. With the exception of its magnificent Roman remains, Orange has little to detain the architect; the only portion not modernized of the cathedral is the south side porch.

We now come to Avignon, that queen of Mediæval towns, with its grand old palace, quaint towers, crenellated walls, frowning portals, chapelled bridge, the broad and rapid Rhone, and crested rocks, above all of which rises like a protecting spirit the venerable cathedral of Notre Dame des Dons. The early date to which this building has been ascribed by some authors (amongst whom, I believe, is Mr. Fergusson), cannot, I think, be founded on any good ground: the portal shows the appliance of materials from some late Roman work to its present purpose, and is no indication of peculiar antiquity in a district where Roman remains are common, and their readjustment in new work pretty frequent: as to the body of the building, its masonry, arrangement, detail, and construction resemble so closely other works in France acknowledged to be of the eleventh, and even of the twelfth century, that we are justified in classing it amongst them; and my own impression is that no part of it can be ascribed to an earlier period. Near the altar is preserved the curious and interesting marble chair used by the popes; the back is mitre-shaped, and the sides are carved in low relief with the winged lion and winged bull. The first pope who reigned at Avignon was Clement V., in 1305; and the chair would appear to belong to this period. A more ancient but less attractive relic of ecclesiastical art is to be found in the table-altar, supported by five columns, four angle and one central. It is one of the few examples of this class of early altar that has come down to the present day almost uninjured. There are other interesting subjects in this picturesque building, but the place is so dark as to render it almost impossible, unless, perhaps, on a bright summer day, to get satisfactory drawings.

Avignon is an excellent point whence to make several most interesting excursions; and amongst them I would particularly recommend a visit to Villeneuve les Avignon, for its very perfect citadel and noble entrance-gateway, and the rich and beautifully carved stone monument to Innocent VI. in the chapel of the hospital, consisting of three most delicately-carved pinnacles of open work over an altar tomb, on which is the recumbent effigy of the pope, with his feet resting on a lion. It dates about 1360.

Proceeding down the Rhone, the next interesting Romanesque work is the small chapel on the heights above Beaucaire, belonging to its ruined castle. It consists of a plain barrel-vaulted hall, entered by a round-headed portal, under a square tower. The openings to admit light are very small, round-headed, and plain-beaded: the masonry, of the usual good Romanesque character, consists of smallish square blocks, neatly worked, the corbels and arch-band forming the principal ornamental features. The interior is now completely gutted, and serves as the abode of the *concierge*.

At Tarascon, on the opposite bank, we meet with the first indication of a complete change of style, in the south porch of the cathedral, rich in mouldings and ornament,—dog-tooth, flower, ovolo, and nail-head; with angle columns, and a once richly-carved frieze (now quite destroyed), above which runs a blank arcade, and sculptured string-course, exhibiting unmistakeably the influence of the Arlesian style. The date generally ascribed to it, that of the close of the twelfth century, is probably a correct one. I may here remark that perhaps nowhere is this influence of local styles more clearly defined than in the south of France. At Avignon and Nimes we have a close approximation to late Roman work, with pediments, columns and friezes; the mass being plain; at Arles, St. Gilles, and Tarascon, deeply recessed and many moulded portals richly sculptured; and at St. Trophime, Montmajour, and St. Remy, cloisters of a distinct type; at Narbonne, Carcassonne, and Toulouse, the single broad-spanned interior and long lancet windows of a later date are quite peculiar; and the Romanesque buildings of Toulouse, with their high and many-staged brick towers and angle-headed openings, are of a marked local character.

But let us return to Arles. The interiors of the churches here are very simple, and of the usual Latin cross plan. At St. Trophime, the piers are plain and square; the caps flat and roughly worked; the archivolts plain and semi-circular; between them are corbels supporting piers, with angle colonettes, from which spring the plain flat bands of the barrel-roof: but it is to the sculpture that I wish particularly to allude. The centre of the portal contains the Saviour and the emblems of the Four Evangelists, with the Twelve Apostles below; the archivolt being ornamented with rows of ministering angels: the great frieze represents, to the right of the Saviour, the good led to Heaven; and on his left the wicked, strung together with a rope, and dragged by the devil to Hell: beneath these are the large statues of the Apostles (the Four Evangelists being on large lion pedestals), the statue of St. Trophime, the Martyrdom of St. Stephen, and the ascension of his soul to Heaven.

On the sides of the porch are—to the left, Adam and Eve at top; beneath them an angel weighing the souls of men in scales; beneath that, the devil holding the condemned upside down, which seems to have been a favourite idea of punishment with the sculptors here; under this, again, along the pedestal of the column is a large reclining figure, nude, but with an animal's skin above his back; he holds a lion, on another side of the pedestal, by the hind leg: this subject, the man, however, being dressed, occurs in the same position at St. Gilles, and clearly means Sampson. On the other return of the porch are represented goats, a ram, a dog, &c., probably symbolic of wickedness; beneath which stands a great fiend, holding his victims upside down, and in other unpleasant attitudes: he stands upon a dragon, and beneath the whole are the flames of Hell.

Such are the main features of this porch. Let us now enter the cloisters, the capitals of two

sides of which are historiated, or carved with Scriptural and legendary subjects and foliage. The angle panels of the piers on entering are carved with the Saviour's Ascension, angels at the tomb in the centre; soldiers sleeping at the tomb beneath: on the return are, above the Three Maries, Judas receiving the Price of Blood beneath: at the next angle to the left, are angels emerging from clouds, the Transfiguration in the centre; the disciples beneath: on the return the Martyrdom of St. Stephen, to whom the church was originally dedicated. At the next angle the Kiss of Judas, the Last Supper in the centre; and the Saviour washing the Disciples' Feet beneath: on the return, the Temptation on the Mount; and below, John baptising the Saviour.

Such are the principal subjects pourtrayed on this building; and they are so interesting in point of subject and style, the date also being probably posterior to the year 1152, when the remains of St. Trophime were transferred here, that I would place by their side some notes from other sacred buildings of the same period, and by their comparison we may arrive at some suggestive conclusions. I propose also to separate from this class of sculpture, that represented by the corbels, which, when brought together and compared, will open, I think, another view of their particular meaning.

We are now standing before the three very richly-sculptured portals of St. Gilles, about fifteen miles south of Nimes, similar in style to St. Trophime, but profusely ornamented, the round-headed entrances being rich in column, moulding and ornament. In the centre is the Saviour, seated in an oval aureole on a rainbow in the clouds (Heaven), his head encircled with a glory of alternate star-point and flame; round him are the usual emblems of the Evangelists; the left semicircle contains the Adoration of the Magi; the right the Crucifixion. Beneath these runs a great frieze, containing the life of the Saviour; beneath this is a band containing crouching animals, lions, bulls and others, and human heads. On each side of the great entrance are two Evangelists on lion pedestals, and four apostles to the right and left of these: on the extreme right and left, carved on the wall, are two archangels standing on and spearing the Dragon, and the enemy of man, respectively. The small subjects on the pedestals represent Sampson, Cain and Abel, a centaur and stag, an old lioness and her young disturbed by a figure, now destroyed; David and Goliath, and David feeding sheep. Other smaller and less important subjects are partly scriptural and partly symbolic.

At Moissac we have another very interesting sculptured portal, in the abbey church of Saints Peter and Paul, also a work of the twelfth century, the arches of which are broad-pointed: the entrance consists of a recessed porch, on the left side of which are represented, at top, a figure pointing to a scroll (meaning, probably, "It is written"); next to him is Lazarus, represented in grave-clothes, and of infantine size (as departed spirits are always shown), resting on Abraham's lap; then comes Lazarus reclining (but of the same size now as the other figures), with dogs licking his wounds and angels watching over him; then Dives feasting at table. Beneath these are large groups of devils punishing Avarice and Lust; the soul of the miser is being carried off by one demon, whilst his bag of money is taken from him by another: he is on his death-bed, and his wife vainly weeps over his corpse, whilst grinning demons watch his death-throes: beneath are two large figures of the devil seated on the miser's shoulders, grinning horribly, whilst by his side a naked woman has her breasts sucked by serpents, and from the mouth of the demon by her side springs a toad; amongst the monstrous corbels of this side may be remarked also a goitred cretin head, popular belief of that day having adjudged this unfortunate people to be the devil's own; two of the caps on this side have, amongst the foliage, demons with bellows fanning the fires of Hell and torturing the condemned. There is a certain grotesque horror about all these figures which may have served in early times to have impressed the beholder with fear and awe. This is the side of the wicked; and on the opposite wall is represented the salvation of the good. First at the top is the Flight into Egypt. Mary and

Joseph approach the city gates, and the idols fall from high places, as narrated in the apocryphal Gospels; next comes a group apparently the return to Palestine; beneath is shown the Adoration of the Magi, in two groups; and below these the Annunciation, and the Meeting of Mary and Elizabeth. In the centre of the arch is the Saviour, in an aureole, with crown and nimbus; the winged animals of Revelation, symbolic of the four evangelists; seraphim, angels, and ten elders with lutes and vases. or, as it is described in Revelation, "having every one of them harps and golden vials full of odours, which are the prayers of saints:" these are all surrounded by clouds, indicative of Heaven; the remaining fourteen crowned elders with lutes and vases minister beneath to the Lord, forming a frieze or sculptured lintel. On the left of the doorway is St. Peter with the keys, and on the right, St. Paul, probably, with a scroll inscribed "Ecce virgo conferet" (Behold, a virgin shall conceive), the prophecy of Isaiah (vii. 14). The central piers, of alternate lions and lionesses resting on each other's backs, and with a figure without the nimbus, at each return, holding one a book, the other a scroll, I do not pretend to explain. The external mouldings and splays of the arches are carved with separate single pieces in relief, of fruit, leaf, fish (some of which have the heads of ducks and foxes), birds, and lastly, next to the door angle, animals, the whole forming together a sort of epitome of the creation, *i. e.*, the days of vegetable, piscatorial, and animal creation. Although out of our immediate province, I cannot pass by the richly-carved cloister of this abbey without remarking also a curious illustration of the Book of Revelations found on two capitals. One is formed by the symbols of the evangelists, a cable necking, scroll angles, and an abacus carved with foliage, and eight lions with their tails entertwined; on the other cap an angel descends from a cloud (Heaven) and leads a dragon captive by a chain, with the inscription, "Serps anticus qui est Diabolus;" whilst on the other side of the cap, after his thousand years' imprisonment, he issues forth from the porch of his prison to meet two men, who appear to receive him with upraised hands, expressive of astonishment or fear; under the dragon is written "Golias," under the men, Gog and Magog (Revelations, xx, 1, 2, 7, 8); the necking is a plain torus, and the abacus is ornamented with *scales* and foliage. This is merely mentioned as evincing a connected idea and appropriate ornament. The subject of sculptured capitals would carry us into a wide disquisition. My own impression is that a complete investigation would prove that certain subjects were chosen as a general rule, and applied to different parts of the sacred edifice, doorways, windows, capitals, bases, and corbels, each having certain classes of subjects adjudged to them, either by absolute rule or by traditionary custom.

We will conclude this, I fear, dry catalogue of subjects on the Romanesque façades with a brief notice of St. Croix, at Bordeaux, probably of a somewhat earlier date, *i. e.* of the eleventh century.

The extrados of the centre arch is carved with angels; next come the elders, crowned, and worshipping, with music and incense, harp and vase, a central figure at the apex, intended for the Lord: the next broad band has the beginning of the zodiac, but this was apparently a mistake of the workman, and was never carried out. After this comes a row of kneeling figures pulling a rope, which binds together two seated figures at the apex, probably the marriage of the Saviour and the Church. On the arch to the left, Avarice is represented in five groups, each consisting of the Miser and the Devil, in various stages of downward fall; and on the right arch are five groups representing Lust, each of a woman (clothed and not naked as at Moissac), with an attendant demon, and the usual toads and serpents.

The first thing to be remarked in this enumeration of subjects is that, in the main, they are entirely scriptural; illustrations, in fact, of the Old and New Testament. The Virgin Mary never is found as a prominent figure, and legendary subjects are not usual. The great points are purely Christian, such as the "Glorification of the Saviour," "Lord of Heaven," and "Judge of this world,"

as described in Revelation; and the power of the Apostles, amongst whom naturally the Evangelists are especially honoured. Besides this Scriptural sculpture, we have moral sculpture, reading a lesson, and holding out a warning to what the church considered the two great vices, avarice in man, and lust in woman, a very *naïve* and curious illustration of what the priesthood naturally considered most innate with each sex, although our own sex did not always escape reproof, as shown by the very coarse and matter-of-fact illustrations of lust to be seen in the churches of St. Paul, at Narbonne; St. Sernin, Toulouse; and St. Jean, at Valence.

We have also symbolic sculpture, such as the small pedestals of columns at St. Gilles, and at Arles, in which bears, lions, centaurs, &c., play an important part. Without going to the extent of Durandus, Cahier, Lewis (not the honorary secretary of the R. I. B. A.), and that school, it is impossible, I think, to deny a meaning more or less definite to these apparently fanciful subjects; and I should feel much obliged to any member learned in symbolism who would explain the centaur and stag from St. Gilles.

Concerning the style of art shown in these works, it is most decidedly of a Byzantine type. In the earliest, such as the very curious marble reliefs round the choir of St. Sernin, at Toulouse (probably of the ninth century), the folds of the dresses are few, and raised in a crease. This method holds good at Moissac (three centuries later), although the heads of the figures naturally show a great advance in art. At Arles and at St. Gilles the folds are minute, peculiar, and of strongly-marked Byzantine character: and this is more evident on a statue in the Museum at Toulouse, preserved from a destroyed church there, and which, besides its value in point of execution and style, is interesting as being signed by the sculptor Gilibertus, or, as he signs himself on another statue, Gilabertus.

My impression is that these works were chiefly executed by French sculptors, after a model or illustration given to them, which, if not actually Byzantine, was formed on a Byzantine sampler.

The figures on the façade of St. Croix, at Bordeaux, are most curiously Assyrian in character. The same remark holds good to some portions, especially drapery, of the sculpture on the cathedral at Angoulême; and it is a question whether Greek or other workmen were not actually employed on some portions. Mr. Lewis (this time it is our excellent secretary that is meant), in his very interesting paper on Arab Architecture, speaks of the impressment of all kinds of workmen by the Spanish Moors, and it is not unlikely that retaliations took place on the part of the Christians, or that Greek workmen (then the most skilled of their time) were here and there employed expressly.

The subject which most took my attention in these Romanesque churches was the corbel, since its explanation was the most difficult, and, I believe, has been but little considered by archæologists. Let us compare some of them. First, on the façade of the Beaucaire chapel, we have a goat's head, a cock's head, a leaf, an eagle, a lamb, a leaf, a lion with a human head in its mouth, a monster (mutilated), and a demon's head, roaring, nailed to the corbel.

Next, at the cloister of Montmajor, near Arles, a bear, a goat, a bull, monster and human heads a leaf, a lion's head with a human head in its mouth, and a lion's head devouring a small naked human figure. Then, in the cloister of St. Trophime, a goat, a figure (man) in sumersault, a bird much mutilated, but apparently a cock, a running figure, a donkey's head and neck, a lion with a human head in its claws, a female figure in somersault, a lion, an angel, and a long-horned goat. And at St. Gilles (façade), a small angel in foliage, a human head in foliage, a ram, an eagle with a sheep in its claws, a lion's head, a bull, a running figure, and a leaf. The corbels on the façade of St. Trophime are nearly the same as those in the cloister.

Now, I am not going to assert that these are the only subjects to be found on the corbels of the

Romanesque churches; for, not to mention numerous others, at Moissac alone may be remarked a man and woman kissing, a figure holding its mouth open with its hands, a head with water apparently over one eye, one figure laughing, another scratching his head, a fox, monsters, grotesques, and foliage, which can hardly bear serious interpretation (I mean Scriptural interpretation). But it does seem most probable that these animals and figures, so constantly repeated, allude to the animals present at the birth of Christ; and that the peculiar bars sometimes seen on the corbels, as at St. Sernin at Toulouse, Notre Dame at Clermont, represent the manger. As the old church hymn has it,—

"Cognovit bos et asinus
Te, magnus mundi dominus."

Indeed, most of the minor incidents connected with the birth and youth of the Saviour are seen, just as at a later date the accessories of the crucifixion, the sponge, the nails, &c., were brought into use. The domestic animals are those present at the birth; the ass bore the Holy Child into Egypt (at Arles it is represented kneeling); the falling figures male and female, are the gods and goddesses that fell at the child's approach; the angel in foliage appeared to the wise men of the east; the running figures are the messengers from Herod; the lions with figures or heads in the mouth and the claws are Herod, as temporal power, destroying the infants; the monster heads are enraged demons, whose doom is now come; and the nailed devil's head, which occurs at Beaucaire, at Arles, and later still, at Dijon, where he has a ring in his mouth, typifies his fall through the birth of the Holy One.

However this may be, a most interesting collection of sculptured corbels might be made, the result of which would be, I think, to show that the earliest examples bear directly or indirectly on the birth and youth of the Saviour; that other subjects were gradually introduced, until they became as varied as at Moissac; and that, when the pointed style took shape and gave greater scope to the individual sculptor, new ones were introduced at will, whilst the old traditionary subjects were still retained. Thus, in the cathedrals at Poitiers (dating early in the thirteenth century, and a most noble monument of the early pointed style), we find in about 300 corbels of the interior, a mass of purely secular subjects, sometimes characterized by a power of caricature and broad fun which would be worthy of a modern pantomime. Having just allied the lion's head with the temporal power, I cannot refrain from saying a few words on the lion and his meaning in Romanesque sculpture. We must remember that the lion may symbolize several things, and that it is necessary to discriminate, by his position and attitude, his meaning. Taking St. Gilles only, we find him on the band which runs beneath the life of the Saviour, slinking and crouching with his head to the ground, and his tail between his legs; he is also in company with tigers and serpents and dragons, whilst human heads, with an intense expression of fear turn away from him; he is here the evil one, roaming about like a lion seeking whom he may devour, but crouching in subjection and fear beneath the feet of the Saviour and his apostles. Now the lion, as we know in a secular sense, always signifies force or power. The Byzantine emperor on his throne, with moving lions, is minutely described by historians. The mediæval judge had his seat *inter leones* and the lion's head, head and claws, or entire body, occur universally on thrones, &c., as allied with power, secular and ecclesiastical. We are then, I think, justified in taking the lion, with a human head or figure in his jaws or claws, to typify the abuse of power. At St. Gilles the four Evangelists stand on moulded brackets, which rest on lions' backs; and, although one is too much injured to make out, yet we have still remaining three of these lions of the church. Two of them are tearing to pieces human figures—a woman and a man—which I take to represent a heathen god and goddess: the most perfect is a man naked to the waist, and thence clad in a sort of antique trouser; there is no mistake here; the lion savagely clutches one arm with his mouth, and with his right paw, the claws well out, drags the naked flesh of the man's side in

strongly marked creases. The man's head is unfortunately broken off, but beneath it, and proceeding, may be, originally from his mouth, creeps away a dracontine creature, symbolic of the evil one escaping from his hold. Next to this a lion holds a lamb (or ram rather, for I believe it has horns); he, however, does not in this case destroy, but protects; resting one paw, with claws retracted, on the sheep's back, and the other on his head; it is clearly an attitude of protection, and the head is placid. Here we have the lion of the Church ready to defend the Christian—"Ye are my sheep,"—who rests evidently happy and at ease beneath his fostering care. The bases of the small columns of the left doorway rest on two lions couchant, who with reverted heads gnaw at the base; this is probably the power of the wicked which the church keeps down, but which is for ever biting its bonds. Besides these interpretations we shall find the lion sometimes employed as a type of David (the Lion of Judah), and also not far removed from any figure of Sampson or Daniel; I say not far removed, because the old sculptors were not very particular in keeping the lions and the heroes together, as may be seen at St. Trophime and at St. Gilles, in the case of Sampson; and on the porch of St. Porchaire at Poitiers, and in the cloisters at Moissac; where, if my memory does not deceive me, the lions are shown on one side and Daniel on the other: on the St. Porchaire portal at least, Daniel is in an aureole with angels overhead on a capital to the right, and the lions on the capital to the left, with the inscription "Daniel inter leones."

I will now revert to a still earlier period of Christian art, as exemplified in the very important and interesting series of sarcophagi preserved in the museum at Arles; dates unfortunately are wanting, and the names, which are Roman, though the persons were probably Gauls, afford no aid; they may, however, be generally assigned to be between the third and sixth centuries. They are of the usual Roman sarcophagus shape, carved with subjects from the Old and New Testaments; those most in vogue were the Saviour and the apostles, sometimes in a continuous row, sometimes separated by columns. Once here, and once at Narbonne, we find trees instead of columns, very tastefully arranged with birds in the foliage; the trees are apparently olive, and the birds are doves: the miracles of the Saviour; these also are sometimes continuous, sometimes divided by colonettes; in the centre is usually a female figure with hands outstretched, intended, no doubt, for the Virgin Mary. From the Old Testament we have mostly Moses striking the rock, Pharoah in the Red Sea, Daniel in the lion's den, and the sacrifice of Isaac. The tomb of the Labarum is carved with the twelve apostles, without division; a line of cloud passes behind their heads with stars, and over each head a lion's claw holds a wreath or crown: in the centre is a large wreath, containing the monogram of the Saviour resting on a cross with two doves: two soldiers kneel at the foot of the cross, one on each side; over the apostles are two genii or angels, supporting circular medallions containing a male and female bust; and again, two genii holding an oblong tablet without an inscription: each angle terminates in a large mask, the facial line forming the angle; on one side is St. John baptizing, and on the other Moses striking the rock. This tomb is known locally as that of Constantine; it not improbably belonged to his family; and we may conclude it to be a work of the second half of the fourth century. Sculpture is here seen founded on a good model; but somewhat rough of execution, and heavy in proportion. The faces are singularly *à l'antique;* some of the apostles are of the Jewish cast, of the best kind: no nimbi occur in these or in any other example (except one rough and unimportant one) in the collection. The dress consists of tunic and sandal; all the eyes have holes in the pupils, and generally also at the angle next the nose, to give expression. The whole character is strongly marked Roman; though the heads are large, the hands clumsy, and the style conventional, yet there is a certain simplicity and nobleness about them by no means to be despised. Some few of the heads are indeed first-rate, exhibiting such peculiarities as to lead one to conclude they are

portraits; at any rate we find here a school of sculpture at an early Christian period, the best I should say then existing, and which ranks much above the stupid faces and lanky figures, the streaky hair and stiff drapery, the minute folds and jewelled borders, of sculptured art in the same district which reached its bathos in the twelfth century. However tempting it is, I must not continue my meditation among the tombs, and will only add that at Narbonne, Toulouse, Lyons, Vienne, and Moissac we meet with numerous sarcophagi, in which foliage and Christian emblems take the place of figures, which fell into disuse probably from want of good sculptors; and yet it is curious to see how closely the same model, conch-shell, columns, and figures, was followed at a later period, *i. e.*, the eleventh and twelfth centuries.

No one should leave Arles without paying a visit to the ruined Abbey of Montmajour: not to speak of its situation, perched on a rocky island, as it were, rising from the well-watered plain, encircled with the olive and laurestinus, capped by the frowning tower of defence and refuge, the palatial ruins of the Italian style, and the grey, sombre, Romanesque abbey, with its dark, vast mysterious crypt and sculptured cloister, these alone would well repay the walk; but besides these, are the rock-cut church, of a most primitive and remarkable type; and the mortuary chapel of the Holy Cross. The latter was built in the early part of the eleventh century, square on plan, with four semicircular apses and a western porch; the roof consists of a funnel-shaped dome; there are no openings for light; and when the *concierge* slams the door violently a whole park of artillery seems to be discharged, echoing faintly away into solemn silence. With the exception of the baptistry at Pisa, it produces the most extraordinary reverberations I ever heard, and if Mr. Roger Smith is ever in that part I recommend it to his notice; the masonry of this building is a perfect model of execution. Proceeding from this to the primitive church we remark the rock honey-combed in all directions with open graves, the former occupants of which in their simple devotion sought to be interred as near as possible to the Holy Cross; vain, however, was the hope, their resting-places are now bare, and their ashes are scattered to the wind; whilst the Holy Cross, if any true portion of it ever was there, served probably to light a fire in the revolutionary troubles of the eighteenth century. Descending by steps in the rock we enter the narrow passage of the original church, and a few steps bring us to an oblong space with circular roof cut in the rock; on one side is a plain window opening, on the other two are stone graves above which are cut two round-headed hollows, or niches, now empty; beyond this portion is the church divided into two aisles by columns; on one side are three round-headed windows, on the rock side is a long low stone seat; there is a small semicircular apse to one aisle, and in the other is an altar in the wall with an open space beneath, probably a place of interment; and passing beyond this, through a passage barely large enough to admit one person, we come to four separate apartments, quite plain, with only one small light at the end of the passage, a curious rough stone chair by the window, two stone seats, and a so-called rock-cut bed. The round roof is formed by the rock itself, except in the chapel, where it is built; it is in the chapel also that the only ornament is found, the style of which may be assigned to the tenth or eleventh century. Tradition ascribes this rock-cut church, with its graves, altars, confessional, stone seats, and sleeping apartment to the Saints of the early church at Arles; the more especially to St. Cæsaire, Bishop of Arles, in the sixth century: nor do I think but what its existence may date from that epoch, although probably enlarged and ornamented at the time of the foundation of the great abbey, in the early part of the eleventh century; for this curious ornament of Christianity contains in itself on a small scale, catacombs, chapel, hermitage, and place of refuge and defence, the whole serving as a place of safety from the Goths and Saracens, who over-ran Arles in the seventh and eighth centuries; and bears a marked analogy to the crypts or *cubicula* of the catacombs at Rome, which served as mortuary chapels and places of instruc-

tion for the *catæchumens*, having stone benches for pupils and penitents, and stone chairs for teachers and confessors.

The entire group of buildings here forms a most interesting study for the archæologist and architect, and I hope if any member of the Institute visits Arles he may be enabled to dedicate a few days to their pictorial and descriptive study. Nor must we leave this district without saying a few words about the curious Mediæval village or town of Les Baux. The traveller leaves Tarascon by omnibus for St. Remy, and must wend thence about ten miles *en voiture* to Les Baux. As regards picturesqueness nothing can exceed it: a fortified town, perched on the natural fortification of a rugged rock, and surrounded in all directions by upheaved granitic masses, it is the ideal of a robber knight's eyrie; its value, however, to the antiquary has been much overrated, for, except the ruined castle and hall, which appear to belong to the thirteenth century, most of the remains bearing any impress of architectural art are of the sixteenth century. The rock-cut houses, which may belong to any period, and are of the rudest arrangement, form the most striking and curious feature of the locality; they are, however, quite plain, with the exception of a few ruined chimney-pieces of the fourteenth and fifteenth centuries. A curious columbarium, or pigeon and dove-cot, that necessary larder of live stock for the besieged, formed by numerous holes partly cut in the rock and partly built, still remains.

The only Romanesque remains at Nimes are to be found in the cathedral façade and at a house on the *place*. Of the former very little remains, but what there is exhibits a close following of a Roman model, with frieze and pediment, not often seen even in this last home of Roman architecture. The frieze, very roughly executed, illustrates the first books of the Old Testament, commencing with the Serpent twined round the Tree of Knowledge; on one side Eve, whom he addresses; on the other Adam, who seeks to hide his nakedness. This combination of different points in one story is common with the early artists. The next subject is defaced. In the third, Adam and Eve are hiding themselves in trees, their busts only being seen. The Lord addresses them. We have then the Expulsion; the Offerings of Cain and Abel; the Murder of Abel; Noah and the Ark; Lot and his Sons; and so on, all these subjects being continuous, as in the early Christian tombs. This fact, and the general character of the figures and drapery, lead me to conclude them to be of very early date. We, in England and the north of France have, perhaps, been too apt to fix on the first half of the eleventh century as constituting a clear line of demarcation in the history of architectural and sculptural art. It was so with us, no doubt, in a very great measure, but in the south the course of art was more even; and in this particular example I think we may discover one of the earliest efforts of native artists at constituting a style founded on the Roman models left them, and which finally received a peculiar character from its combination with the semicircular arch, which we remark also on this façade on a small scale, and quite devoid of moulding or other ornament. The base of this cathedral appears to have had also a large frieze, on which some remains seem to indicate the form of the griffin, but all the rest of the building is too mutilated or altered to admit of investigation. What remains of the house, which was no doubt the bishop's palace, shows some very good sculpture, which is so essentially similar in style and subjects to certain parts of the church of St. Gilles (circa 1090), that we may ascribe it to the same period. I am happy to say that Monsieur Henri Revoil, the Government architect at Nimes, is engaged in publishing a work, with carefully measured drawings and with letter-press, on these monuments of Romanesque architecture in the south of France (the first part of which will appear this summer, published by Bance, at Paris), and which I venture to recommend to the notice of the Institute. No complicated system of construction is to be found in these buildings; the semicircular arch and dome in various combinations give, in this respect, its only claim to anything like science; and these are frequently heavy, and not well adjusted; solidity and

simplicity are, however, not bad substitutes for the more complicate and often less reliable systems of aftertimes; the mouldings are generally Greco-Roman, combined with the hollow and torus common to Romanesque art everywhere; the ornaments of the mouldings are generally Roman, the ovolo, leaf-fret, dentil, &c.; the capitals of the columns, where not historiated, are mainly founded on a Corinthian or Composite type, and the bases are usually Attic. The sculpture, as a rule, is stiff and lifeless, and the drapery, especially on the more richly-clad statues, of a thoroughly Byzantine character. The masonry is of medium-sized blocks, slightly oblong, well worked, and carefully set in thin beds of mortar. No ornamental inlay is found, as in Auvergne and at Lyons; no combination of brick and stone, as at Toulouse; and we may affirm that few more interesting classes of buildings are to be found for the architect and archæologist than these Romanesque churches of the South of France. It is impossible to leave this district without putting in a word also for the grand remains of Roman architecture which ornament its soil; the noble walls of the theatre at Orange, the grand arcades of the arenas at Nimes and at Arles, the richly-sculptured triumphal arches of St. Remy and Orange, the colossal aqueduct of the Pont du Garde, the mausoleums of St. Remy and Vienne, bear witness with a force stronger than the most powerful oratory, to the manly genius and profound feeling for what is noble in architecture which characterized the old Roman race. However admirable, picturesque, and striking, however full of interest to the lover of Christian art, the most ambitious works of Mediæval Europe may be, yet, owing to the littleness and confusion of their parts, they appear as the work of pigmies in comparison with the grand simplicity and indestructible strength of these labours of the giants, against which the violence of man and the corrosive envy of time have expended themselves in vain.

On the direct route between Nimes and Toulouse there is not much Romanesque work; the interior of St. Paul, at Narbonne, exhibits, in the sculpture of the capitals, some curious applications of the palm combined with figure subjects, among which appear some very coarse and matter-of-fact representations of the vices of man; the exterior of this church is in the Pointed style, as are all the other principal monuments of this old but somewhat uninteresting city. The museum, however, besides the early Christian tombs before alluded to, contains some good bits of Romanesque art, in the shape of capitals and fragments from buildings now destroyed, two richly-worked bronze censers, and a pastoral staff, in ivory, very plain, ending in the usual serpent-headed crook, on which stands an angel regarding an empty chair or bishop's throne. The eighteenth century is also peculiarly well-illustrated in this museum, owing to the bequest of a local collector, who confined his attention almost entirely to that period. From this point the traveller should by all means endeavour to visit Perpignan, with its Mozarabic and Spanish styles of architecture, and the adjacent church and cloister of St. Elne, so remarkable for the Egyptian character of several of its capitals, executed early in the eleventh century.

At Carcassonne, with the exception of some unimportant portions of the cathedral of the old town, everything is Mediæval. Carcassonne is Monsieur Le Duc's pet patient; he is busy trying to bring the old body to life, and rehabilitate its decayed and shrunken form; but although the doctor appears to have it all his own way, and to prescribe regardless of expense, I cannot say that the result is satisfactory; there is something ludicrous, to my mind, in this expensive and useless restoration of old fortifications, nor can one approve of the wholesale manner in which old work is pulled down and carted away to make place for new. I must add that here, and in almost every case where this distinguished architect (to whose research, taste, and industry we are all so much indebted) has added designs of his own, whether in stone or in metal, they appear to me to be of the most eccentric and emasculated character; the same rather anomalous result struck me also, during a late tour through Germany, as regards Herr Heideloff's designs.

At Agen some good bits of Romanesque architecture remain in the choir and apse of the cathedral, but more interesting than these are some old arcaded streets which still exist in the centre of the town. The breadth of the pavement is about 25 feet, that of the street about 40, and the width between arches about 20 feet. The houses themselves are modernized or rebuilt, but the plan still holds good, and as the weather was very wet, and I had not an umbrella, my blessings fell on the departed manes of the old municipal authorities. The same remark applies to the Bastide, or Freetown of Libourne, near Bordeaux, the great square of which measures about 180 feet each way. The passages are about 21 feet broad, the width between the arches about 14 feet; this example, though more complete, is ruined in effect by the lowness of pitch and narrowness between the piers of the arcade. The rest of the town, though of modern construction, still retains the right-angle arrangement of street common to most of these (what may be termed) "model towns" of the fourteenth century.

But we are hastening on somewhat too fast, for we have got beyond Toulouse, a city which, besides its very remarkable Romanesque churches, possesses decidedly the most important and interesting museum of antiquities to be found in the south of France; these are deposited chiefly in the cloisters of the suppressed church of the Augustine Friars. The most numerous and varied section relates to Romanesque art, and we have here tombs, capitals, statues, and friezes ranged round the open traceried cloister, in a manner which recalls pleasurably to mind the charms of the Campo Santa at Pisa. I do not mean to uphold the design or contours of these capitals and ornamental bands as exhibiting any remarkable degree of study and refinement, but they have hardly received the attention they deserve; their character is, in a high degree, rich, bold, and effective.

The museum contains numerous most interesting inscriptions; and it is to be remarked that in one of the oldest, that on the very curious slab tomb of St. Victor, at Marseilles (1048), we find the same style abbreviated, by placing small letters within large ones, as at the Abbey of Moissac, on the sculptured figure of Abbot Ansquetil (1100). This custom, with the use of Roman letters, continued down to a comparatively late period, and one of the earliest examples of the use of Gothic or German letters is to be seen on a tomb in the Museum, dated 1347. Two of the figures on the portal of an ancient church, now destroyed—that of La Daurade, I believe—retain the sculptor's name; they are the best of the series, and the sculptor clearly was proud of his work. One has *Gilabertus me fecit*, the other, *unincertus* (?) *me celavit Gilibertus:* these statues are draped thoroughly in the rich Byzantine style, with small folds and gem-studded borders. Amongst the more fragile treasures of antiquity up-stairs, although it will not be shown without some trouble probably, the archæologist should not fail to see the so-called horn of Roland, which (if it really belonged to him), may be the one the hero died blowing, as he vainly sought with its notes to retrieve the rout of the Paladins. It appears to be the work of an European sculptor, after the Byzantine manner, and was probably a tenure horn.

The most noble monument of Romanesque art in Toulouse, and, indeed, of the south of France, is the celebrated church of St. Sernin. It is built of brick and stone, as a five-aisled Latin cross basilica, with a semicircular apse and five apsidal chapels. There is a west entrance, with two north and two south ones. The general character is large and massive, the ornament pure and good Romanesque, and the brickwork very careful, judiciously relieved by courses and dressings of a warm-coloured stone. The whole is surmounted by the peculiarly fine brick tower, of five tiers of arcades, with which we are so familiar through engravings and photographs. The church is stated to have been finished and consecrated A.D. 1090. The best sculpture is to be found on the doorways, and I take the subjects of the south porch (nave entrance) as an example. The cornice of the projecting

wall shows the peculiar ornament and pateræ of Nimes cathedral combined with the brackets of Notre Dame du Port, at Clermont. The archway is semicircular, and in the centre is the Saviour in glory, attendant seraphim and angels, and the twelve apostles beneath. The angle corbels of doorway are formed by David seated on a lion's back, playing the viol, on one side; on the other, two men, seated cross-legged, and caressing lions. The capitals of the columns are carved with subjects from the life of the Saviour, monsters, foliage, &c. There are two columns on each side; the mouldings are the plain hollow and round; the corbels of the cornice show in succession a monkey with a lion's head in his paws, a bunch of grapes, a lion, a monster vomiting his own legs, a young woman's head with wild dishevelled hair, a matron hooded, a goat, and an animal too much broken to be made out. It would be difficult to explain the two saints carved on each side of the portal, with allegorical sculpture above and beneath.

But however interesting the exterior may be, the interior is equally remarkable, and the marble slabs of the Saviour and the Apostles on the choir wall, stated to be saved from the old church, built by Charlemagne, particularly merit notice. It is with great regret that an accident prevents my giving a more detailed description of this church. I understand that Monsieur Le Duc intends dedicating a monograph to it.

Toulouse is rich in buildings of the Mediæval and Renaissance periods; the brick towers of the churches of the Augustines (*musée*) and the Jacobins (*caserne*) are modelled on, and rival the tower of St. Saturnin. The cathedral contains many portions of good Pointed architecture of various dates, and some good painted glass of the fifteenth and sixteenth centuries; the triforium is peculiarly rich and effective. Adjoining St. Saturnin is a large brick house of the fourteenth century, crenellated and arcaded, with angle turrets. It formerly stood within the wall which surrounded the church precincts, and is still in fair repair, externally. The present *Lycée* retains many picturesque and remarkable Late-Pointed portions, while its Renaissance court is peculiarly striking. The "pestilent" Renaissance buildings of Toulouse (mostly mansions) are, indeed, as a rule, very broadly designed, noble-looking, and well calculated to satisfy the eye of every properly-educated architect.

There is not much Romanesque art except at Moissac, on the direct route between Toulouse and Bordeaux, at which city the monuments of Mediæval architecture, civic and ecclesiastic, are very beautiful and interesting: the artist and architect will find plenty of work there. But we have now passed almost beyond the boundaries of the south of France, and, however tempting the subject, I must leave for a future day the Romanesque buildings of the centre and the north, and conclude what I am afraid will already have been to many present "a twice-told tale."

Mr. Fergusson, Fellow, being invited, said that, if Mr. Waring had been present, he would have asked him upon what he had founded his opinion as to the date of the cathedral at Avignon. The capitals referred to were certainly not Roman, nor the pediments either. On the whole, he (Mr. Fergusson) thought the church was in all probability built before the Mediæval age, that is, before the ninth or tenth century.

Mr. Morris, Associate, said he thought there was a great infusion of the Saracenic into what was termed the Romanesque style of architecture in France. It should be borne in mind that the south of France was invaded by a large Arab army, who advanced north as far as the Loire, and who were routed by Charles Martel. The number of Arabs who poured into the south of France at that time were said to be enormous, and tradition asserted that Martel had dispersed as many as three hundred thousand. At all events, the host was so large that it was not unnatural to suppose that the *débris* might have remained in the country, and exercised some influence over its architecture.

With regard to grotesque ornamentation, he might mention that, at Ripon Cathedral, the stone sedilia were defaced with carvings of a profane and somewhat indecent character; and among the figures were human heads with the bodies of beasts clothed in the canonicals of the time; and there was a tradition that these were the caricatures of one class of the clergy upon another,—perhaps the regular caricaturing the irregular.

Mr. Street, Fellow, in proposing that a vote of thanks be accorded to Mr. Waring for his interesting paper, said he was not personally familiar with all the churches to which Mr. Waring had directed attention; but that, from what he did know, he thought that, upon one point, Mr. Waring had hardly done them justice; for the Romanesque architecture which he (Mr. Street) had examined on the banks of the Loire was particularly rich in beautiful foliage.

Mr. Ashpitel, Fellow, observed that, from the examples of the older churches he had seen in the neighbourhood of Avignon, he agreed with Mr. Fergusson in thinking, that though not of the classic period, they contained a strong element of classic art. The general design was nearly Basilican; the mouldings, caps and bases, and the carving of the foliages, all showed classic traditions. In fact the whole country round must have been full of buildings, or portions of buildings, erected by the Romans when these churches were built. With regard to the centaur mentioned by Mr. Waring, he did not think that many of the fabulous or incongruous figures put up by the early or Mediæval architects were intended to be grotesques, and to convey a comic satirical meaning. The Egyptians, for instance, had the sphinx and the dog-headed anubis; the Greeks and Romans, the chimæra and griffin; but everyone knows these to be emblematical and not grotesque. The centaur itself was clearly of classic origin, and the type of a nation of equestrians. But besides emblematical figures, many things taken for grotesques were astrological; in fact it was very probable the centaur in question might represent the sign Sagittarius. Another reason for the prevalence of grotesque ornamentation in the churches of the date of those described by Mr. Waring might be traced to the narratives of early travellers, such as Marco Polo and others; who, on their return, most probably described in exaggerated language a good deal of what they had seen, and, perhaps, what they had not seen. These traditions were current in the Middle Ages and were illustrated in Nuremburg Cathedral and other buildings. Outlandish and strange races of men were described and depicted; and it would be remembered that Milton had spoken of the anthropophagi and other monsters—men whose heads did grow beneath their shoulders,* When so many of these grotesques were observed, it was but reasonable to conclude that they were not all got from one source; neither did he think that, if they were traced to their probable origin, they were so wild or absurd as they were generally supposed to be.

Mr. Burges, Fellow, referred to the illuminated volume of the works of Ovid in the library at Rouen, from which it was evidently intended that a Christian moral should be derived. Many of the figures were drawn with half the body of a perfect man and the other half a beast. At Lucca

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* In the celebrated "Chronicon Chronicarum," printed at Nuremburgh by Koberger, 1493, fo. xii., is a very curious series of representations and descriptions of the monsters described by Sir John Mandeville, Marco Polo, and others. Among these are the *Cynocephali*, or men with dog's heads; *Cyclopes*, having only one eye in the middle of the forehead; *Pannothi*, men with ears so large they cover the whole body and serve for garments; *Unipodes*, men with only one foot, who nevertheless run so fast as to catch the swiftest deer; *Hippopedes*, men with horse's hoofs instead of feet; *Monopodes*, men with one foot, which is so large they go to sleep under its shadow, holding it up like an umbrella to keep off the sun. Besides men with no heads, the eyes, nose and mouth being on their chests; men with four eyes; others with six heads; in fact, every conceivable monster. But these were really supposed to exist in foreign countries, and therefore if sculptured could not fairly be termed grotesque.

Cathedral, also, there was a figure half man and half bull. It might be meant to convey the transitional position of man, half developed.

Mr. Bell, Hon. Sec., agreed with Mr. Fergusson as to the date of the buildings, although Mr. Waring had given them a later origin by two or three centuries. He thought it impossible to regard them except in connection with the Roman remains, which were found everywhere in the neighbourhood. He thought the Institute were much indebted to Mr. Waring for having called attention to this most interesting country, which was full of fine remains of the Roman and Byzantine period.

Mr. Seddon, Fellow, called attention to the very erroneous ideas of "restoration" now carried on in reference to the ancient monuments of France. In many instances the fine old sculpture was taken down and broken up for the roads, in order that modern carved work of a very inferior description might be substituted. He was informed the other day that it was the intention to "restore" the front of the church of St. Michael, at Lucca, by pulling down the west front, with all its magnificent sculpture, and rebuilding it! This, surely, could not be regarded in the light of a restoration. He regretted to say that even in England this mania for "restoration" had broken out, and he could mention an instance which had come under his own knowledge in which grotesques had been taken out of their places because they were a little broken, and modern objects put up in their stead, which were grotesque simply because they were ridiculous.

Mr. Hayward, Associate, said that Mr. Seddon's observations afforded him an opportunity of unburdening his mind of a weight which had clung to it for the last twelve months. When he went to Mayence he was disgusted more than he could tell at seeing fine pieces of sculpture detached from the cathedral and lying in the mason's yard beneath the walls. Among them were some magnificent heads 4 feet high, which had been wantonly pulled down, in order that others might be put up in what was supposed to be a better manner. Whoever had the charge of restoring the ancient churches of France ought to be informed of what restoration really was, because it was quite clear that they knew very little about it. He could find no language in which to describe the additional disgust which he felt when he visited the abbey of St. Denis, near Paris. This church had been thoroughly spoiled, and the crypt, which once contained a magnificent collection of tombs, was denuded of them, in order that they might be catalogued in historic order in the choir. In order to effect this object the floor had been adjusted so that the whole thing might be converted into a show-place or museum. He had been informed that the ultimate intention was to place a great monument in the centre, in which were to be deposited the remains of the first Napoleon. He suggested whether the Institute might not bring some influence to bear upon those responsible for these "restorations," in order to save the churches from what could only be termed wanton destruction.

Professor Donaldson, V.P., thought that, as far as the abbey of St. Denis was concerned, there was very little antiquity in the tombs to which Mr. Hayward referred. In fact, all that was being done there was taking away one sort of rubbish and setting up another.

Mr. Papworth, Fellow, observed that some of the tombs in the crypt of St. Denis were made about the end of the seventeenth century, and that they bore a remarkable resemblance to each other. There was a system of restoration at present going on from the north to the south of France, in which everything was being scraped in a most remarkable manner. At Rouen every church had been subjected to this process, and at Paris the buildings had literally lost all trace of their original character.

Mr. Street corroborated the statement of Mr. Papworth, and said that in every part of the country which he had visited he had found an army of discontented workmen rubbing away at

everything they could find. It was the fashion to praise the present Emperor of the French, and to give him credit for restoring and renewing and preserving the national monuments, but the probability was that in ten years they would be all destroyed. The church of Notre Dame, for instance, was completely coated over with new work. The French not only restored Mediæval works, but, if any ancient statue had a nose or a finger knocked off, down came the whole thing, and a modern abomination was stuck up in its stead.

Mr. Kerr, Fellow, said that, in considering the restoration of ancient monuments in this country we were bound to regard them in connection with important intellectual movements. No such movement, however, had been going on in France. Instead of whitewashing their churches, as English churchwardens did in the last century, the French re-worked them; and in doing so could only bring such limited archæological knowledge to bear as they possessed. If, however, they were deficient in archæological attainments, it must be conceded that they possessed many other valuable qualities.

Mr. Burgess said that, in point of fact, no such edifice as the Abbey of St. Denis now existed. It was utterly spoiled many years since. Some years ago an attempt had been made to restore the tombs to their original positions. In Louis Philippe's time a terrible restoration took place in the sculpture, and Blessed Virgins were metamorphosed into apostles, and apostles into Blessed Virgins.

Mr. Ashpitel expressed his regret that in candour we were compelled to admit that this description of restoration was not altogether confined to our neighbours across the Channel, but that we ourselves occasionally indulged in the same eccentricity. Some little time since on visiting a church, the name of which he could mention, he observed two terminations to the label over the chancel arch, one of them was an escutcheon in the ordinary position, on the other side an escutcheon reversed, or point upwards. Now this latter is an abatement or mark of dishonour, and said by Gerard Leigh to shew that the bearer had fled from his Sovereign's banner. The subject of heraldric abatements had been matter of much controversy, many denying they had ever been in use at all. In fact, Menestrier quietly sets it down as "une sottise Anglaise." Not being able to get at the shields which were at some height, nor to make out what was on them as they were so daubed with whitewash, and being short of time, he determined to pay the church another visit, and then found it had been "restored," every trace of the shields was gone, and the whole place so altered it could hardly be recognized; an opportunity of obtaining light on this interesting disputed point being thus lost for ever. In another place he found that new foliated capitals had been put up; and, on asking a gentleman, who appeared to be the incumbent or the curate (he did not venture to inquire which), the reply he got was: "Well, they were rather broken about, and these are very much better, I assure you." Worse than all, it had been reported at the Society of Antiquaries that some incumbent had such a passion for Minton's tiles that he had them laid not only over the old tile paving, but over the gravestones themselves; shutting out, perhaps for ever, the memorials of the dead, and the evidences of family rank, descent, and fortune.

The Chairman, Mr. G. Godwin, V.P., in putting the motion that the thanks of the meeting be accorded to Mr. Waring for his paper, observed that there was a strong feeling with one section in France, that what was being done in the way of restoration was hurtful; and that in all probability what had passed at the Institute that evening might reach some who were charged with the duty, and might lead them at any rate to consider the matter. It should he thought be borne in mind that there were different circumstances under which restoration might be effected. If, for instance, a church was in decay, the parapets falling away, and the tracery of the windows decaying, and the parishioners or the owners desired to keep up the fabric for use, the only thing to be done was to try

and restore it to a condition of soundness by substituting new work as it originally existed. The other state of circumstances to which he referred was the undertaking the restoration of an ancient monument, such as the royal tombs in Westminster Abbey, or ancient sculpture not needed for use. Such works should simply be maintained carefully, as handwritings of the past and rich in associations. With regard to the district through which Mr. Waring had carried them in his paper; it was certainly matter of surprise that so few English architects even now visited these towns. He had himself been in the country some years ago, and at the principal inn where he put up he was informed that they had never received there but two Englishmen. The dome-covered churches of the district, Angoulême and Poitiers, were full of interest. He thought they were much obliged to Mr. Waring for the information which he had given them.

The vote of thanks was carried *nem con.*

ON SARACENIC ARCHITECTURE.

By Sir Gardner Wilkinson, F.R.S., Honorary Member.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, 18th March, 1861, by Professor Donaldson.

The various styles of architecture have their history; and their rise and progress are as necessary an inquiry, in studying their development, as are their peculiarities of character when arrived at full maturity. They are sometimes treated as if each were a distinct creation of its inventors, independent of any elements derived from an earlier source; and we hear of the origin of the several styles as if they had been autochthonous in their respective countries, and the offspring of the native mind, unaided by any foreign or adventitious influences. But few—I might perhaps say none—of the various styles of architecture so originated; for I do not include under that head the primitive efforts of man when in an untutored and barbarous state; and, though man at first supplies his wants by the humble dwelling required as a shelter, and erects some religious emblem or sacred enclosure to his God, no sooner is he sufficiently advanced to give to his building an architectural character than he is open to receive impressions from more civilized people with whom he comes in contact. No architecture, therefore, reaches its full development without being indebted to one or more older styles. It is true each has its distinguishing types, which give to it a particular character; but much is always superadded to its original elements; and even the Egyptian, though apparently so very distinct and peculiar, is not an exception to this general rule.

It is sometimes difficult, in tracing the progress of Egyptian architecture, to ascertain how much was added to it from other styles, since no monuments older than or even as old as those of Egypt remain; but it is evident that foreign elements were admitted into it, and many details introduced at various periods are found not to bear the stamp of native origin. In the sacred edifices, however, the character of the architecture was essentially Egyptian, though it varied much at different periods, particularly between the fourth and nineteenth dynasties; and it is in the highly-decorated tombs that a new style of architecture and of ornament is most discernible. These tombs admitted of great variety, and thus the semi-circular or round arch, unknown in the temple,* was there introduced, constructed of brick or of stone, or represented in the hewn rock. Indeed, we even find the form of the pointed arch there used in this imitative and conventional manner.

Both these arches were invented in a country where the problem of covering large spaces with bricks had to be solved; and the two brick-making districts where they were first employed were unquestionably Egypt and Assyria. And though, from our knowledge that the round arch† was commonly used in Egypt as early as 1500 B.C., and probably more than 500 years before that period in the brick pyramids of Memphis, we may conclude that it was an Egyptian invention; still, I believe the pointed arch to have been invented in Assyria, and to have been imitated from that country in a hypogeum at Thebes, which dates about 1460 B.C.; for there is no evidence of the existence of a *constructed* pointed arch in the valley of the Nile until long after its round, or semi-

* Except one or two solitary instances of Roman time, in out-of-the-way places, as at the Oases.

† It is common in the brick tombs at Thebes. The oldest stone arches yet discovered are of the time of Psammetichus, about 650 B.C.

circular, a companion had been commonly used; and the oldest pointed arch now known there forms the roof of one of the chapels, or sanctuaries, attached to a pyramid at Gebel Berkel, the site of Napata, the old capital of Ethiopia; which, though built by a native architect, appears to date during the early part of the Roman empire. It is constructed with the keystone, and the blocks are arranged lengthways, as were the bricks in the oldest round arches.*

I must not, however, allow myself to deviate from my principal object; and I only mention these facts connected with the architecture of that most conservative people, the Egyptians, to show how even they borrowed from a predecessor, or from a contemporary; as did the Greeks, in their architecture, their vases, and many of their decorative designs; and, as the Etruscans and Romans borrowed from the Greeks. It is in the later periods when the Romanesque, the Byzantine, the Lombard, the Saracenic, and others, formed themselves out of the elements of those which preceded them, that I wish more particularly to notice the gradual production of new styles of architecture; and of these I shall content myself with the Saracenic, which I am induced to do by having (not indeed without surprise) heard it stated that there is no Saracenic style, and that it is merely Byzantine.

That the Saracenic borrowed from the Byzantine is perfectly true; and this, as I have already observed, is quite in accordance with the history of other styles; but, though any one of them may be originally derived from a predecessor, it is not on that account precluded from assuming a new and independent character, when it has remodelled and adapted those elements it found suitable to its requirements, and has made them its own; and in all cases it may be safely predicted that each new style is derived from more than one parent. The architecture and artistic ornament of ancient Greece are sufficiently decided in their character; and yet, if we were to claim from them all they derived from others, we should deprive them of many most essential features, and should prove that we had not observed how this very habit of adoption and adaptation was one of the merits of the Greeks. They perceived the beautiful wherever it presented itself, and they scrupled not to borrow even from the so-called "barbarian," who in early times was as much more advanced in taste than the Greeks, as the Saracens were than the Crusaders who affected to despise them; and it is this very habit of adoption and adaptation which we should do well to practise at the present day, in preference to the too frequent effort to introduce some novelty, from a love of variety or notoriety, or the mistaken notion of *invention* in art.

To deny the existence of a particular style of architecture because it borrowed from another, is to ignore the very history of architecture. As well might we deny the existence of the Italian school of painting becaused it owed its first ideas to the Byzantine Greeks, and because the earliest masters of the Florentine, Sienese, and Pisan schools, as Cimabue, Guido, and Giunta, with many others, derived their earliest lessons from those of Constantinople.

Any one who knows how Saracenic architecture commenced, how it advanced, and how it became a distinct style, will admit that it only went through the usual phases of transformation common to others, which have been derived from one or more predecessors, and that it advanced by a very reasonable transition from its first condition of pupilage to a new and independent state. But though

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* It had been unfortunately pulled down before I visited Gebel Berkel in 1849; but a drawing of it was made by the Duke of Northumberland and General Felix, who represent it with the keystone. Mr. Hoskins gives it without a keystone, as does Caillaud, but all agree that it was pointed, and not round, like the other arches there and at Meroë. If the stone were not cut to a considerable angle at the joints, they could not be placed together as they are lengthways, to form a pointed arch, unless the arch had a keystone; and the necessity for this member is clearly shown in the early pointed arches of Christian time in Egypt, which are constructed on the same principle, with the bricks placed lengthways.

the Saracenic was beholden for its origin to a number of progenitors, perhaps in a greater degree than any other style, yet, in some countries, it was actually not indebted to Byzantine influences, *in the usual ratio*, at the time when its first germs were developed. It sometimes merely borrowed certain ornamental details.

At the period of their earliest conquests, when the Arabs advanced into Syria, and captured Damascus, in the summer of 634 A.D., neither their wants nor their taste had aspired to the erection of buildings dignified by beauty of design; and the practice of architecture was still unknown to them. They were only acquainted with a very primitive form of building in their own country; and for some time after they had established themselves in Syria and in Egypt they employed Christian architects, and were not themselves sufficiently acquainted with the arts of construction to erect any large building, As the early Christians adopted the basilica, or in some cases the Pagan temple, the Moslems sometimes adopted the Christian church, or borrowed ideas from their pagan predecessors; and in many instances the churches of a conquered province, having been relieved of the distinguishing emblems of Christianity, were readily appropriated to the unadorned services of Islam. Indeed, they were sometimes satisfied in obtaining from the Christians half of a church as a place of worship; and the great church of St. John the Baptist, at Damascus, continued to be the joint property of the two religions from the capture of that city, in 634 A.D., to the reign of the Ommiade Caliph Weleéd, A.D. 706; and, though said to have been pulled down and replaced by the present mosque, and to have received the name of Giama-Beni-Ommééh, or El Ammowee, from its supposed Ommiade founder, it evidently was merely altered by him; and the decay of the white-washed stucco on the exterior of the walls supporting the great dome, with which the scruples of the "Faithful" then covered and concealed the coloured mosaics and their golden ground, reveals here and there the original ornamentation of a Christian time. Moreover, from the appearance of this rectangular building, it is evident that the roof above its pediment was heightened at the time when the dome was superimposed upon it; and that the side and end walls, including the pediments, are of Christian date; so that we at once perceive how much has been introduced by the Moslem architects upon the once continuous line of the roof between the two pediments. Mr. Porter also states that on its inner walls and piers this part was coated with the finest marble, in beautiful patterns; while, on portions of the wall above, and on the interior of the dome, may be seen fragments of fine mosaic, representing palm trees and palaces. There is also a Greek inscription, of Christian time, of which he gives a copy, and which, with the mosaics and its general plan, sufficiently establishes the date of the building. The dome, according to Mr. Porter, is nearly 50 feet in diameter, and above 120 feet in height.

The few mosques erected about that time by the Moslems in Syria were marked by many characteristics of the Christian style, and certain Byzantine features continued to be attached to them in that country, but these were chiefly confined to the cupola and ornamental accessories; and, even then, every new building acquired that variety of feature which, through their extended conquests, was speedily introduced into the architecture of the Arabs. In Egypt, Barbary, and other countries, the same number of Byzantine elements did not find a place, even in the earliest mosques; and this is only consistent with what might be expected, since their style was at first that of each country where they happened to be erected; and we are not, therefore, surprised to find that, in those of the oldest time, the dome is wanting in Egypt and in Barbary, and the principal characteristics of Byzantine architecture are rarely, if ever, to be traced there. Indeed, it was not till a much later period that the dome held an important position in the mosques and tombs of Cairo; and the oldest raised there were those which bore the least affinity to the Byzantine style, as I shall presently have occasion to

show. Nor do Saracenic mosques present the most distinguishing features of that architecture. We look in vain for that arrangement so peculiar to it,—of the upright wall, with its row of arches standing over others springing immediately from columns, so well known in Santa Sophia, at Constantinople; in San Vitale, at Ravenna (built also in the time of Justinian, A.D. 534); and in other churches; nor are the bridge-like galleries or columnar screens, so remarkable at St. Mark's, in Venice, met with in any Arab mosque.

These, and other Byzantine features, are as much at variance with the character of a Saracenic building, as would be the triforium of one of our cathedrals; and, while Byzantine churches differ in their character from an Egyptian mosque, what can be more unlike the former than the earliest mosques of Cairo? as, for instance, those of Amr, of Ahmed-Ebn-Tooloon, of El Hákem; built, the first, about 642 A.D.; the second, in 879, and the third, in 1003, A.D.; in none of which did the founders introduce the dome, or any of the most marked peculiarities of Constantinople. If we compare their hypæthral rectangular court, and the covered corridors that surround it, with their flat roof, to a Byzantine church, I will venture to say, that no plan or elevation could be found more at variance with them; and the very feature which claims the most-marked relationship to the Byzantine style—the dome—was not introduced into the open court till centuries afterwards, or about the end of 1200.

Such hypæthral courts, with their surrounding colonnades, bear a much nearer resemblance to those before ancient Egyptian temples; and the area and portico of Luxor, or any other of those marked monuments, might be thought, at first sight, to have a claim to be the prototype of these Moslem court. Even the colonnades of a Roman forum, and some Roman temples, like that at Zaghwan, near Tunis, or, like those round the courts at Baalbek, with a similar peristylar arrangement,* bear a greater resemblance to those of the mosques than any Byzantine building. In the Arab edifices above mentioned, we see no domical structure, nor any of the peculiarities of Byzantine architecture; and the cupola, or *kobbeh*,† in the area of the mosque of Ahmed-Ebn-Tooloon, was not put up till the reign of the Melek Munsóor-Hesám-e'deen-Lagéen, A.H. 696, in the month of Saffer (answering to A.D. 1297—98), as recorded in the Arabic inscription it bears.

One style may borrow many features from another, without being indebted to it for its origin. Thus, the first idea of the pointed arch may have come to us from the Saracens, with whom it was in common use at least as early as 879 A.D.; and numerous other peculiarities of their architecture may be observed in our so-called Gothic, various Arab characteristics, found in early buildings of France and other parts of Europe, being common in those of Cairo and every Arab city; and the church built by the Crusaders at Beiroot (now converted into a mosque) has the pointed arch decorated with the Norman chevron.‡

But neither these nor St. Anthony's church at Padua, with its minaret-like steeples and its borrowed character, come under the category of the Saracenic style; nor does the introduction of certain peculiarities into architecture suffice to confine it to that particular style from which they were derived. The long sojourn of the Crusaders in the East, and their wars and occasional alliances with the Moslems of Syria and Egypt, will readily account for the introduction of a new feature into

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* It was found in Herod's temple at Jerusalem, and other buildings, and something of the kind occurs in our cloisters.

† *Kobbeh*, or *Cubbeh*, "a dome," is the origin of the Spanish, Italian, and English words for cupola (cubola), implying a hollow form. The Arabic *kubai*, a "cup," *kuf*, the "palm of the hand," and the Greek κυβή, κυφος, κυφή, κυπελλον, κυψελή, as well as *capsula*, and our own cup and cap, the Celtic *copan* (*cwpan*), &c., are from the same root.

‡ The chevron is the common moulding throughout the Palace of Diocletian, at Spálato. It is also found slightly modified in the mosque of Ahmed-Ebn-Tooloon, derived, of course, from a similar Roman source.

European architecture, and the pointed arch—a very dominant one in our Gothic buildings—came to us from the Arabs; but the mere introduction of certain forms or peculiarities does not affect the *style* of any architecture, and the manner in which the pointed arch was adapted by the Gothic builders, its bar tracery, so different from the pierced or plate tracery of the Saracens, and the constructive purposes to which it was made subservient in vaulting and in covering large spaces with small materials, gave them a claim to originality in its use, and made it a new element in European architecture. And here we have another of those very remarkable instances of the adoption and adaptation of a feature under new conditions, which prove the genius exhibited in its application, and mark the practical talents of those who develop an idea obtained from a foreign source.

I cannot here enter into the lengthy question of the pointed arch, and I shall only notice its use incidentally as it bears on the present subject; but I may observe that the early English arch is so distinct in form and treatment from the Norman, that it could not possibly have arisen out of it; and no modification would lead from the former to the latter. The two are totally distinct from each other, and the notion of the intersection of two Norman arches having originated it is opposed to reason as well as to fact. For the pointed part accidentally lying between them is *not an arch:* it is the mere intersection of lines; the only arches there are the two round ones; and no one would construct an arch on that principle, *i. e.* with the arrangement of the stones as they there stand in relation to each other. This supposed pointed arch is no arch at all; and he who would build one in imitation of it would have a strange notion of the principle of a pointed arch. It has no more claim to that name than any round arch seen in perspective, or any accidental intersection of ornamental devices, or the meeting of the boughs of trees, which have indeed been gravely put forward as the origin of this arch. Besides, pointed arches had been used long before the Normans had any intersecting arches, or had even settled in France; and it would indeed be an anachronism to derive them from what was not yet known, especially as they were already common elsewhere at the same period.

The marked change from the Norman, Lombard, and other round, to the pointed arch, could only have been owing to the sudden *adoption* of the latter from an *established style;* and, as we know where it was in general use, and that it was found by the Crusaders in the east, and adopted by them in the churches they built there, before it came to Europe, we have no difficulty in determining the source whence it was derived. But though the original idea was borrowed from the Saracens, the pointed *style* in Europe became a distinct architecture, and claims this merit as the Saracenic claims to be independent of the Byzantine. In examining this point it is well to bear in mind that it is not Syria, but rather Egypt and some other countries, where the Byzantine element was far from dominant, which lay claim to the earliest development of this new style; and the oldest works in Egypt, of known date, are totally at variance with the form, as well as the constructive and other main features, of Byzantine buildings.

The conquest of Egypt began in A.D. 638. Babylon, afterwards called Fostát, and now Old Cairo, was taken by Amr in 639, and Alexandria at the end of 640; and soon afterwards the whole of Egypt fell into the hands of the Arabs. It was at this period, A.D. 642, that the two mosques were first *founded,* which still bear the name of *Giáma-t-Amr;* one near old Cairo, the other at Asoóan; and the tent of Amr, like those commonly used by the Arabs, of goats' hair, being called *Fostát,* gave its name to the new city which took the place of Egyptian Babylon. The mosque of Amr, therefore, being the first erected by the Arabs in Egypt, or, indeed, in any of the conquered provinces, is of the highest interest in the history of Saracenic architecture. Nothing, however, appears to exist of the original structure; and the only part which dates during the first century of

the Hégira is probably a portion of the exterior wall on the south-eastern side,* which bears the impress of a mode of building common at that period. Indeed, the whole edifice was altered, and apparently rebuilt between the years 642 and 712 A.D., and as at first it measured only about 75 feet in length by 45 in breadth, its plan must have undergone considerable changes ere it reached its present dimensions.

In the reign of Abd-el-Mélek (the son of Merawán I.) great alterations were made by his brother Abd-el-Azées, about A.D. 699; and by Weleed in 712-713; as well as by the Abbaside caliphs; and under Mamoon, the son of Haroon-e'-Rashéed, its dimensions had increased to about 435 feet in length by 225 feet in breadth.† It was also repaired by Ahmed-ebn-Tooloon, and by his son; by El Hakem-be-Omr-Illáh; by Yoosef-Saláh-e'deen (Saladin); and by others: extensive additions appear also to have been made at the beginning of the year 1400 A.D.; and other repairs date as late as the time of Murad Bey, at the close of the last century.

It has been supposed by some that the arches of the interior, which spring from columns, and form the hypostyle of the Mekkeh end, are a portion of the early building; but this is an error, as they are built against an older wall, and actually cover part of the old windows (since blocked up).

They are not even of the date of the Abbaside caliphs; and their style at once proclaims them to be about the time of Soltán Moaïud, A.D. 1412-1421,—an opinion confirmed by the fact of the mosque having been repaired at the beginning of that century. The windows in the wall itself are of much earlier time; and others, also of early character, form above them an upper tier; but the latter are not visible from the inside, as the roof intervenes between them; and it is only from the outside that they can be seen, together with the whole elevation of the wall, which rises considerably above the present roof.

This upper tier consists of windows having alternately round (inclining to oval) and pent-roof heads; and in some are the remains of the stucco which once held the painted glass with which they were filled, probably by some early restorer of the building, who raised the roof. This upper tier of windows was then added to the lower wall, in which, ranged at intervals, are the clusters of one large central and two small lateral round arches, seen in the interior.

The portion of this south-eastern wall which at its eastern extremity bears, as I have before stated, strong evidence of being the oldest remaining part of the mosque‡; and you at once perceive where later repairs have been introduced towards the north, after some dilapidations had occurred on this side; half of an arch being there filled up by the more recent brickwork.§ There, too, an

* I call it the south eastern, though these mosques do not face exactly to the south-east; and the direction of this end in the mosques of Cairo is more to the south than south-east. That of Ebn-Tooloon stands about twenty degrees east of south, or seventy degrees south of east.

† The court of the mosque itself is now about 380 feet by 355 feet; and the length of the whole building is about 550 feet by 355 feet. Macrizi, according to Mr. Stanley Poole, states that about 211 A.H. (A.D. 827), the mosque, without the two additions, measured 190 (architect's) cubits in length, and 150 in width.

‡ Through the kindness of my friend Mr. Stanley Poole, who has sent me the detailed account of this mosque by Macrizi and Aboo Saeed-el-Himyeree, I have been enabled here to introduce a correction of the statement I had made that this south eastern portion belonged to the original structure raised in the time of Amr. I am still inclined to think that the lower part of it dates as early as 93 A.H. (712 A.D.); 1st, because Macrizi speaks of the "niche existing in his day," which had been built by Kurrah, in the reign of Weleed; and 2nd, because it is evidently the oldest part of the mosque. Unfortunately, Macrizi's account is not sufficiently detailed to enable us to ascertain the dates of the several parts added and repaired. I particularly recommend the valuable remarks of Mr. Stanley Poole to all who are interested in "Arabian Architecture," on which he writes so ably; and his authority is of the greatest weight in all matters connected with the history and literature of the Arabs. They are in the appendix to the last (5th) edition of Mr. Lane's Modern Egyptians.

§ The oldest appears to be, first, the lower part of this wall; second, the portion above, with the small windows; and third, the restoration, which may be cœval with the south-west side.

imitation of the older part is sufficiently obvious; and the difference in the construction of the arches in the two portions at once pronounces the later one to be a copy of its older neighbour. They imitate but they do not perfectly resemble the older arches, having their jambs higher, and their heads (especially those of the pent-roof form) less lofty, or of a more obtuse angle; and a difference of construction may also be observed in the wall below. These facts appear to confirm the account given by Macrizi of the manner in which the mosque was enlarged. They also accord with modern tradition; and if the latter * asserts that it was built in imitation of the temple of Mekkeh, this could only have arisen from the notion that its open court was copied from the enclosure of that holy place, as neither the internal arrangement, nor the cubical-shaped sanctuary of the Kábeh, was here adopted. But in fact, the sacred enclosure of Mekkeh and the open court of the mosque of Amr were both later additions; and the former was, in Omar's time, merely surrounded by a low wall of separation, afterwards replaced by the arcades with cupolas then added round its hypæthral court—a form of peristyle said to have been first introduced from Persia,—instead of the simple architrave and flat roof of an earlier time, which last was supported on columns made of the trunks of palm-trees.

The occurrence of round arches, alternating with those of the pent-roof, or angular head, will readily call to mind the niches in the theatre of Taormina, in Sicily, which have a similar appearance and arrangement: they are also of brick, and of the same character, with a hood over the arch, or a layer of bricks intervening between those of the archivolt and the superincumbent wall. Of this alternation of the round and angular-headed arch many instances occur, in Roman times, of a more ornamented character in the form of pediments over windows or niches, in stone, as at Nîmes, of the time of Augustus; at Baalbek, in the smaller temple; at Diocletian's baths at Rome; and other buildings: it is also seen in the wall of Constantinople, and in the baptistry of Ravenna, built A.D. 451; and it has long been fashionable over the windows of modern European houses. And as it was employed at so early a period, we are not surprised to find it in a building evidently erected by the Coptic Christians of Egypt. The style of construction in the old portions of the *Jáma-t-Amr* is the same as that in the neighbouring convent, which still remains within the old Roman station at Babylon; and as its brick windows, added by the Christians in the upper part of the stone wall above its southern gateway, have the same character as those of the mosque, they at once proclaim the source whence the latter were derived, and the very usual and even necessary assistance obtained by the Arab conquerors from native builders.† One of its peculiarities consists in the hood placed over the arch, already alluded to; and, as it is found in several early Christian buildings of the time of the Arab invasion of Egypt, we know it to have been commonly adopted there even before this mosque was erected; and the same style of construction appears in the small pointed arches built by the Christians in the same century. It also occurs (somewhat stilted) over the windows of the Red Convent near Soohág, in Upper Egypt,—a building supposed to be of early Christian time, though completed much after its pretended date, the reign of Constantine. This hooded pointed arch continued in use a long time afterwards; and it not only appears in the south-west front of this mosque, which is probably of a rather later date than the above-mentioned portion at the south-

* It is not an idea of Europeans, but of some of the Cairenes themselves; and, though erroneous, it is only right to attribute it to its real authors. Indeed, it is obvious that the Moslems, rather than Europeans, would be desirous of supposing one of these mosques to resemble that of Mekkeh.

† It is in the convent above this gateway that the curious inscription on wood, of the time of Diocletian, occurs, over a doorway once leading into the church.

eastern side, but is found in Arab buildings (as at Asouan), over stilted arches, of about 1070 A.D. and at other later periods.

The south-western front of this mosque is remarkable for another feature, which soon became so marked in Saracenic architecture,—the pointed arch. It here alternates with the round one in the lower, as that with the pent, or angular head does with the round arch in the upper tier; and though the pointed arch had been occasionally used of very limited dimensions, as already stated, before the Arab conquest (A.D. 638), this was probably one of the earliest instances of its regular employment in the walls of any large building. It may have been introduced on some few occasions, as in Assyria and at the Pyramids of Napata, and in subordinate positions to cover passages, and spaces of limited span, at a much more remote period; but its first development was unquestionably due to the Arabs; and in little more than 200 years after their first conquests it became an established feature of Saracenic architecture.*

In the earliest periods of their history the Arabs were satisfied with imitations or modifications of the buildings of each district where they settled; and this explains the diversity that exists in the character of those raised by them, and by the native architects they employed in different countries; while it accounts for the subsequent combination of various elements in their architecture when they became sufficiently advanced to form a new and independent style; for we must recollect that the Moslems, from the time they conquered Syria, Egypt, Western Africa, Persia, India, and other countries, about eighty years after the death of Mohammed, had added whole populations to their ranks; they had long ceased to be merely rude invaders from Arabia; and their converts, long practised in the arts and architecture of their respective provinces, brought with them the knowledge possessed by the Byzantine Greeks, the Copts, the Persians, the Indians, and others who had joined their ranks. No wonder, then, that with such varied contributions to the common stock the new architecture was marked by the remodelled types of so many different styles. The Byzantine Greeks gave it many of its earliest ornamental devices and other features. The Copts, more in favour in Egypt than the Greeks, their religious and political rivals, were constantly employed in that country by the Moslems as builders. Persia, as history and the infallible evidence of style proclaim,† had the greatest influence on the character of its oldest buildings; and we know that architects from that country had long before been employed by Justinian at Constantinople. India, too, furnished numerous marked features; among which may be noticed the minaret, the *mehráb* or niche of prayer, the bracket, and other peculiarities of its monuments; and many instances might be adduced of the spread of the prevailing characteristics of different styles throughout the most distant countries conquered by the Arabs. Some were less readily adopted in certain districts, owing to previous predilections, or to the nature of the climate; in one place covered buildings were a necessity; in another, they were not required; and thus, while previous habit suggested the adoption of the dome in Syria and some northern countries, the Egyptian Moslems did not admit it till a later time, and then only as an adventitious feature gradually welcomed by them, through the influence of the Kurd, Turkman, and Circassian Soltans,‡ who succeeded to the throne of Egypt after the dissolution of the Fatemite Cali-

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* I cannot subscribe to the opinion that the pointed arches of the mosque of El Aksah, at Jerusalem, are of the 69th year of the Hégira, A.D. 689; or that the building is in the condition in which it was when built by Abd-el-Mélek. The walls, and the columns, with their capitals, are probably of Christian time, but the arches of the church (I do not speak of the vaults) are neither of Christian nor of the earliest Moslem time.

† For proofs of this I refer to Mr. Fergusson's admirable work, "The Handbook of Architecture."

‡ The mosque of Soltan Berkook has, by some oversight, been attributed by M. Coste, to the year 1149 A.D., or to 527 A.H., answering to 1133 A.D. It should have been 1382—1399 A.D.; which 240 or 250 years, in the history of architecture

phate, in 1171 A.D. For the oldest mosques in Cairo, of 879 and 1003, as we have already seen, have no dome, or other distinguishing feature of Byzantine architecture ; and the small one in the court, covering the font for ablutions, is of later time. They consist, as I have before stated, of the hypæthral court, surrounded by colonnades, with a minaret on one side, or at two or more of the corners; and the hypostylar portion, at the upper or prayer end, was covered by the same kind of flat roof as the corridors of the court.

Of the architecture of the Abbaside Caliphs we know little, though the distinguished leaders of that dynasty were great encouragers of architecture, as of all the sciences and arts; and the only building now remaining of that period in Egypt is the Mekeeas, or Nilometer, in the Isle of Roda, which, founded by the Caliph Mamoon, was rebuilt by El Motawukkel-al-Allah-Gáfer, the tenth prince of that dynasty, A.D. 862; and the peculiar character of its Cufic inscriptions proves it to be of that age. M. Coste thinks they are of 199 A.H. (814 A.D.), and of 233 A.H. (848 A.D.) ; but they are, at all events, not later than the time of El Motawukkel, or 862 A.D.* Its arches rest on engaged columns, in a manner which recals those of our Norman time; and the capitals have a simple character approaching to the Romanesque, without any abacus or import, but with a heavy unornamented base. In the summer of 1832, I obtained permission, from Mohammed Ali, to remove the upper steps of the staircase, which covered the end of the Cufic inscription, in the hope of finding the date; but though my search was fruitless, I have no doubt, from the simple style of the Cufic, that it is of the Caliph Motawukkel; and the fact of the pointed arch having been in general use, at that period, is fully confirmed by the mosque of Ahmed-Ebn-Tooloon (afterwards enclosed within the walls of Cairo), which has that feature throughout, and was erected in 879 A.D.; as recorded by history and by the inscription still remaining there, which contains the date 265 of the Hégira.† There is another mosque in Cairo, of great antiquity—the Azhár, founded by Góher-el-Kàëd, the general of El Moëz, the first Fatemite Caliph of Egypt, A.D. 972 ; but of the original building, which was very small, no part remains except the niche, which stands in the middle of the great colonnade. The western part with the minaret, is of E' Naser Mohammed, A.H. 736 (A.D. 1336) ; Káëdbay added to it about 1470 A.D.; and it was completed by Abd-E'Rahmán Kéhia, in 1762 A.D.; who at the same time enlarged the small but highly venerated mosque of El Hassanin. But another remarkable edifice of the Fatemite Caliphs, founded by the second successor of El Moëz, still remains in its original state; and this mosque of Soltan El Hákem-be-omr-Illah presents, throughout, the same kind of pointed arches, on solid piers with engaged columns, as that of Ebn-Tooloon; and, like it, is built of brick.‡ The span of the arches is 16 feet 6 inches; those of Ebn-Tooloon, 14 feet 6 inches; and they have both a slight spur, so well known in the round horse-shoe arch; which last form of arch, though little used at Cairo, occurs at the Toolooneëh, in a wall introduced at a somewhat later time between the mosque and its whimsical spiral minaret.

The pointed arch being the one in ordinary use at this period, it is found, as might be expected, in the palace of the well-known Eiyoobite Caliph Yoosef-Saláh-E'deen (Saladin), adjoining the modern

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make a material difference. Soltan Berkook was the first of the Borgite, or Circassian Memlook kings, who reigned from 1182 A.D., to the conquest of Egypt by the Turks, under Soltan Seléem, in 1517; and by these kings the tombs were built outside the walls of Cairo, which have erroneously been styled the tombs of the Caliphs. The Caliphs were buried where the Khan Khaleel now stands, in the city.

* I am glad to find from Mr. Stanley Poole, that this opinion is confirmed by the valuable authority of Mr. Lane.

† The position of this mosque may be seen from my map of Cairo (now laid before the Society); which, though unfinished, may serve to show the locality of the principal mosques, and the original as well as present extent of the city, after the Kalá-t-el-Kebsh, or Kuttaéea, in which the Toolooneëh stands, was enclosed within its precincts.

‡ Mr. Stanley Poole says that the mosque of Ebn-Tooloon was built by a Coptic Christian.

Cadi's court at Cairo, springing from solid piers. It dates about 1180 A.D.: for though this was a portion of one of the Kasráyn, or "two palaces," erected by Goher, the founder of Cairo (A.D. 970), it was probably an addition of the Eiyoobite Caliph, who lived there at the time he added to Cairo its citadel, and replaced with stone the brick walls of its former circuit. The site of one of the two palaces is now occupied, in part, by the Cadi's court; and the spot where they stood is still recorded by the name Bayn El Kasrayn, ("between the two palaces") applied to the space which intervened between them. The same kind of arch continued to be used in the public buildings of Cairo, throughout the reigns of the Eiyoobite and the Memlock Soltans, to the conquest of the country by the Turks in 1517. But while this was so marked a characteristic in the mosques of Egypt, together with the hypæthral court, the dome did not become a prevailing feature there till after the accession of the Eiyoobite or Curd, the Baharite or Turk, and other dynasties; and it was then made subservient to the style already established, being derived from a cognate branch which had developed itself in Syria and other countries. It is also remarkable that the dome was a feature of the Moslem, as of the early Christian tomb. The minaret, too, had been adopted by the Moslems from India; and though the bracket may have been introduced from the same country, there is sufficient evidence of its having been also copied, as by the Moors, from Roman buildings; and arches bracketed, or resting on projecting imposts, may be seen in a Roman ruin at Udine, near Tunis.

Indeed, the custom of using ancones, or consoles, is of very early date, and of Greek time; and columns as well as other members are supported upon them in many Roman buildings, as in Diocletian's palace at Spalato and elsewhere. They answer the purpose of our corbels, derived also from Roman architecture. At Diocletian's palace, too, the arches spring from single columns, without any intervening member between them and the capitals.

If the minaret came from India, it was speedily improved by the Arabs, and nowhere does it possess the same beauty of proportion and elegance of form as in the mosques of Cairo, particularly those built in the time of the Circassian Memlook kings, as of El Berkook, 1392—1399 A.D.; of El Kaëdbay (or Kaitbey), 1468—1496; and many of the preceding dynasty, as of Saleh Eyoob, 1249 A.D.; of Baybers, 1270 A.D.; of Kalaoon, 1285 A.D.; of Naser Mohammed, 1299 A.D.; of El Ashraf-Eenál, 1453; and of the Emeer Keeber. They offer a pleasing contrast to those of the neighbouring Syria; and at Damascus every one admires the minarets introduced there during the rule of the Egyptian Soltans.

The difference of type displayed by the minaret in several countries is, perhaps, more striking than that of any other member of an Arab edifice, and nothing can be more dissimilar than those of Cairo, and of India, and the tower-like Ghiralda at Seville, whose type is so common throughout the Barbary states, and which differs so widely from another minaret common at Tunis, as well as in Syria and some other countries.

I would gladly enter into the merits of these also, but I should extend my paper beyond its proper limits. If, however, I omit all mention of the extinguisher form of the Turkish minaret, or the grand mosques of Constantinople, imitated so decidedly from Sta. Sophia, I feel less regret as their architecture does not properly come under the head of Saracenic, and is foreign to my inquiry.

I have noticed the general use of the pointed arch in Egypt at the latter end of the year 800 and beginning of the following century. It is said to have been employed at the same periods in other countries of Islam; and in India an instance is stated to have been found of the time of Mahmood of Ghúzni, who reigned from 997 to 1030 A.D.

At Kairawán, in the modern regency of Tunis, the old capital of the Fowátem, or Fatemites, the founders of Musr-el-Káhirah, or Cairo, the pointed arch is thought to date at a very early period, and

one which I was shown at Kairawán, in a building covering a well, is *reputed* to be coeval with the Sahába, or companions of the Prophet. I need scarcely say that this is more than improbable. We cannot believe it to be of the age of Moháwiah, in whose reign the city and the great mosque were founded by Ogbá (Okba), A.D. 670, according to Leo Africanus; and, though the simple corbelling of the dome, in the upper part of the building, gives it an early appearance, it does not seem to date as early as Ibraham Ebn-Agleb (Akleb), who established the new dynasty of the Aglebites, in Africa, A.D. 800, and who added so much to the city that he was considered its second founder. He was the same who built the suburb called Rashéed; and the port of Mahdéëh was founded by El Máhdee, the first of the Fatemite kings of Africa, about A.D. 910; and if I mention these two places it is because future travellers in that part of the country may have opportunities of making inquiries there, which I was unable to do, being obliged to return to Tunis in time for the departure of Her Majesty's ship *Beacon* in which my lamented friend, Captain Graves, had kindly given me a passage from Malta. Unfortunately, the difficulty of examining any building at Kairawán and the neighbourhood has, till lately, been very great, owing to the prejudices of the Moslems, who look upon it as a holy city, and are everywhere in Barbary averse to European intrusion; and, when I went there in 1845, only two other Christian travellers had been permitted to lodge within its precincts. I was, however, enabled to make many more observations than I had expected, owing to my speaking Arabic, to my travelling in the Eastern dress, and to the opportunity I had of meeting and overcoming the objections of the people, which last happened in this manner:—On leaving the governor's house, I was warned to be very prudent, and not to excite attention by attempting to draw or write while any one was in sight, particularly while going near the mosques. I took care, therefore, whenever I ventured to make any memoranda, to do so under the cover of my capacious *bornoos* and I had succeeded in avoiding all suspicion till, on coming opposite the eastern gateway of the great mosque, I stopped to examine its pointed arch. Thinking that no one was within sight, I proceeded to make a hasty sketch of it, when some of the faithful, whom I had not perceived within the gateway, came forth in great anger to inquire into my most suspicious proceedings. It was too late to stop and affect innocence; my offence was too evident; therefore, without waiting for the outburst of their indignation, I advanced to meet them, and, after the usual salutations, told them I had come from Cairo, where the learned declared that the Egyptians had invented the pointed arch, but that as the Fowátem princes went from Kairawán to Musr-el-Káhirah (Cairo), and used the pointed arch at that time in their buildings, there was a possibility of its having been employed long before at Kairawán; and I was therefore anxious to know if they could produce any proofs of a prior claim. This so disarmed their prejudices that, with a view of maintaining the claims of their city, they took me to every pointed arch in the place, except, of course, in the interior of the mosques; and, though disappointed in my hopes of meeting with some of great or well defined antiquity, I was enabled to see the one already mentioned, and to copy the Cufic inscription at the city gate, as well as to make other observations, and even hasty sketches of the buildings themselves.

The great mosque is rectangular, surrounded by a high wall, with numerous projecting buttresses and towers, at intervals, 174 paces north and east,* by 101 east and west, having had originally eight entrances, four on the east, and four on the west side, some of which are now closed; and over each gateway is a cupola. The interior I believe to consist of a usual hypæthral court, surrounded by colonnades, with a deep hypostylar hall at the south, or Mekkeh, end. There is nothing on the outside which has an appearance of great age; and from what I could learn, it has been often repaired,

* About 440 feet by 255.

and probably remodelled at various times; though they pretend that it was always restored in exact imitation of the earlier work. The principal minaret, which is called Sómá, stands on the north side, towards the north-east corner. It is a square tower, consisting of three tiers, or stories, capped by a small dome, or cupola, and is said to be the oldest part. It has round-headed arches; but one, over the door on its western side, has a slight inclination to the pointed form. Over the eastern and western doors of the mosque the arches are pointed; but these are probably of no very early time though the corbelling of the cupolas is very simple. They are not very unlike, in this respect, to the Cuboletta, at Palermo; and to St. Giovanni degli Eremiti, built about 1132; and in one place, under the side arches, before the eastern gate, is an Arabic inscription. The round horse-shoe arch generally prevails throughout the exterior of the mosque; and though some are of an oval form, nearly resembling the pointed, few are decidedly of that character except those before mentioned. In the centre of the court is a lofty dome, visible above the walls, similar to, though higher than, those in the mosques of Cairo, where ablutions are performed before prayers.

I afterwards visited another mosque, with three arches in front, which are round, inclining slightly to the pointed form. They have a certain appearance of age, but this is contradicted by the date of the Cufic inscription above them, showing that they were erected A.H. 846 (A.D. 1443.)

Two Cufic inscriptions on a shekh's tomb are of late date, and of a very florid style, but contain no date; and the oldest in that character which I met with at Kairawán is at the gate called Tunis, bearing the date of 437 A.H., or 1046 A.D.

The walls of the city have been rebuilt, and bear the record of their last restoration, in A.H. 1185 (A.D. 1772), which was made by the uncle of the Bey who governed the Regency in 1845. They are surmounted by an ordinary round-headed parapet, and strengthened at intervals with semicircular towers or buttresses.

In point of antiquity, Kairawàn does not appear to possess any monuments of that importance which we might expect to find in so ancient and so sacred a city; nor does it offer any satisfactory proof of the early use of the pointed arch. All that can be learnt on this point from the people is vague and uncertain; and as permission cannot be obtained by a Christian to enter the great mosque, it is not possible to ascertain whether any vestiges are there to be found of the earlier portions of that building. Sufficient, however, may be determined, from its external aspect, to show that the general character of Arab architecture prevailed here as elsewhere, and that it was not of a style to be mistaken for the Byzantine.

The facts already stated are, I trust, sufficient to disprove the opinion that the Saracens had no style of architecture, and that it was merely Byzantine. They also explain why, in the remotest parts of Islam, one edifice was found to resemble, in many of its characteristics, another founded in Barbary, or in Egypt; at the same time that they show why others were different, and why certain countries had their own peculiarities. Indeed, it is easy to perceive how it happens that, though the Saracenic borrowed from the Byzantine, its character was so distinct. Nor is it a singular instance of a career quite independent of the predecessor to which it was indebted for its earliest features. It has been thought, because the Greeks were sometimes employed by the sultans of Egypt to erect or embellish their mosques, that these must necessarily be Byzantine; but so far from this being the case, they fail to be a counterpart of that style, either in their plan or their elevation. Moreover, Copts were, at one time, as much or probably more employed in Egypt as builders; and certain characteristics prove how greatly the Arabs were indebted to the Persians for their assistance and example. I may also observe that many domes of their mosques have more of a Sassanian than of a Byzantine character, as may be seen from the palace of Serbistan, and the great mosque of the Tâk-

kesra (given by Mr. Fergusson, in his "Handbook of Architecture"), which last, built by Nushirvan, or Chosroes (Khosrou), the contemporary of Justinian, calls to mind the large vaulted recesses of the Arabs of later times, such as we see in the mosque of Soltan Hassan, at Cairo; and it is not improbable that Persian taste, welcomed by Justinian while raising the numerous edifices with which he beautified Constantinople, may have also had its influences on Byzantine architecture.

If the Saracens, on their first issuing from Arabia, adopted the churches of the Christians as places of worship, or availed themselves of the assistance of Greek, Copt, Persian, and other architects, in erecting their mosques, they did not object, at much later periods, to profit by similar assistance, nor disdain to borrow from the architecture and even the materials of the churches of the conquered provinces; and a mosque at Cairo, which, by the inscription it bears, proclaims that it was built by Nàser Mohammed, in 698 A.H. (1299 A.D.), has a doorway brought from one of the churches at Akka (Acre), in Syria.* In other parts it displays, throughout, the characteristics of the Saracenic style; but the doorway is singular among those of Egyptian buildings, being of Christian (so-called Gothic) style, with clustered columns supporting a cusped trefoiled head, such as might be met with in one of our churches. It is probably of the early part of the year 1200, or the close of the preceding century.† This work is also remarkable for the character of its cupola, ornamented with the fretwork, which afterwards became so elaborate and florid in the Alhambra and Alcasr in Spain, and which is rarely seen in the mosques of Cairo.

If the golden and coloured mosaics were used at Alexandria, and obtained the name of *opus Alexandrinum*, they were simply derived from the same source as those of Constantinople, and were merely decorative features of Arab architecture, on which I do not pretend here to enter. They adorned a niche of prayer and a few isolated members of a wall, as they adorned a pulpit, or some portion of an early Italian church; but neither these nor any other solitary features are fundamental principles in architecture or proofs of two styles being identical, however characteristic as a mode of ornamentation. The most remarkable of them in later times are in the houses of Damascus and Aleppo. But I abstain from noticing them, as well as the slab work, *intersiatura*, and other inlaid work, the coloured glass, and elaborate fret-work in stucco, and various decorative features, as they would extend this paper to an unreasonable length.

The fact is, the term "Byzantine" has been often used in a vague and inconsiderate manner; and it has been too hastily supposed that every building in which the dome is a dominant feature was indebted for it to Constantinople But not only was the dome not confined to that style, but it was not even first used by the Byzantine Greeks. In Italy, and in some other countries, it descended directly from its first originators, the Romans, without being derived through an intermediate Byzantine channel; and if it passed, through the Greeks of Constantinople, to the eastern provinces of the empire, it was transmitted to them, with certain modifications, merely by the followers of those by whom it had been originally invented; and the credit of its first application on a grand scale belongs very evidently to the Romans.

The Byzantine style has certainly it claims on the gratitude of the Saracenic architects, for having transmitted to them certain architectural features of which they availed themselves during the formation of their own; but it must also be admitted that they soon learnt how to develop and

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* I am indebted to Mr. Stanley Poole for this fact, derived from Macrizi's account of its erection. I had supposed it to have been built for Náser Mohammed by Greek architects.

† It is of course unconnected with the history or *progress* of the Saracenic style, as a similar removal and reconstruction of a doorway might be made at the present day.

improve upon it; and that they were as much, or more, indebted to the Persians and others for the early formation of their style. The changes, too, which the Arabs introduced into the dome were such as to give it a new character. At the same time all will allow that Byzantine architecture was less removed from that of Rome, than was the Saracenic from the Byzantine; yet no one thinks of questioning the existence of a Byzantine style, nor should we doubt the propriety of giving a new name to any one of those styles, which has partly grown out of a predecessor. If we refused to admit this, we should deny the well-known progress and development of art, and should view architecture as if it had no history; and it would be as reasonable to disbelieve the existence of various languages, because they had proceded from one common origin.

Mr. Fergusson, Fellow, inquired who it was who said that Saracenic architecture was merely the development of the Byzantine, in reply to which the paper had been written?

Professor Donaldson said he did not know. Sir Gardner Wilkinson had started with it as an admitted theory.

Mr. Fergusson said he did not think Sir Gardner Wilkinson had clearly described what was the origin of the mosque. The only precept of the Koran with regard to public or private worship was, that every true believer should, when offering up his prayers, turn towards Mecca. Mecca was the only sacred place in the Moslem world; and the main object of the mosque was to show the direction of that sacred shrine. The mosque was, in fact, a wall at right angles to a line drawn in a direction pointing towards Mecca. In the poorer villages of India, the people dug a ditch, throwing up the earth in the shape of a mound running north and south, whitewashed it, ornamented it with flowers, and so converted it into a mosque. The next thing they did, for the convenience of the worshippers, was to make a platform or stone pavement, in front of the wall. In cities and populous places, it became convenient to inclose this space, which was done by building a wall so as to form a courtyard. This done, it became a complete mosque. The next stage was to cover part of this court over so as to form a shelter from the rain, or the heat of the sun. The main and essential part, however, was the wall, and all the rest was considered as merely accessory. Having made the mosque the next thing to be provided was a place for the faithful to make their ablutions. This consisted of a fountain placed in the centre. Then there was the place from which the priests called the people to prayer, and sometimes the roof of the mosque, and sometimes a minaret was used for that purpose. The Moslems, however, had no ceremonials or particular forms of public worship; although, in the great mosques at Cairo, there was a pulpit from which the priest read the Koran on a Friday. The form of the mosques was not in all places the same. In Spain, for instance, there were the remains of Saracenic buildings in the basilica shape. All that Sir Gardner Wilkinson had said confirmed the general belief with regard to mosques, although he had not gone to their origin. It was, he (Mr. Fergusson) thought, a mistake to suppose that a dome was an essential part of a mosque. On the contrary, it was essentially a portion of a tomb; but the Moslems gradually introduced it, and formed it in a bulbous shape because they considered it had a graceful architectural effect, which no doubt it had, when associated with the minarets. With regard to the pointed arch, he thought it was clear that it was used in the East before it was introduced into the West. It was used by the Greeks and Egyptians as a horizontal arch, and it was found among Etruscan tombs. He did not think it was used in the west as a definite feature until the eleventh or twelfth century; but it was used in France at an earlier period, probably in the eighth or ninth century; but, when they attained greater efficiency in the art of construction, they abandoned the pointed arch, and took to the circular. This was a point, however, on which it was difficult to arrive at any correct theory; but he thought it most probable that the Saracens adopted

it for lightness, and the Goths for its constructive features. The Fostat mosque, the oldest in Egypt, and by far the finest, contained the decorative pointed arch, and it was built about the year 650. The columns were Corinthian, and evidently copied from Roman buildings. In some cases he observed that the capitals had been eked out with wood.

Mr. Papworth, Fellow, inquired whether Mr. Fergusson could assign any reason for the existence in some mosques of more than one minaret?

Mr. Fergusson replied that he thought the second was added for ornament to balance the other, for the same reason that there were two western towers to York, or two western spires to Lichfield Cathedrals.

Professor Donaldson said it should be borne in mind that some of the mosques were very large buildings, sometimes 400 feet in length; and it was just possible that two minarets were built in order that the voice of the priest calling the people to prayer might be heard a greater distance. With respect to the shafts of columns called antique, he had examined them very carefully, and he found them so very rough, and the proportions of the bead and fillet so crude and out of shape, that he had arrived at the conclusion that they were of the same date as the mosques themselves. There was an abundance of marble about Cairo, and he was of opinion that the columns were rough copies, and not adaptations.

Mr. Kerr, Fellow, moved that a vote of thanks be accorded to Sir Gardner Wilkinson for his interesting aud erudite paper, and to Professor Donaldson for reading it. He observed that he had listened with great interest to the discussion that *vexata questio*, the origin of the arch; and that he could not help thinking that sufficient attention had not been directed to the theory that assigned to the vault the origin of the arch.

Mr. Papworth, in seconding the vote of thanks, asked whether Mr. Fergusson could explain how it was that the Saracenic appeared to be applied to styles of architecture all over the world.

Mr. Fergusson replied, that it was impossible to prevent people calling names, though it was known that they frequently did so very improperly.

The Chairman, Mr. G. Godwin, Vice-President, said that the profession in general had reason to be much indebted to Sir Gardner Wilkinson, and the Institute particularly so, for that and previous papers; and he had no doubt they would feel it a privilege to join in the vote of thanks to him.

ON THE ARCHITECTURAL HISTORY OF CHICHESTER CATHEDRAL AND ON THE FALL OF THE SPIRE.

Delivered at the Ordinary General Meeting of the Royal Institute of British Architects, April 8, 1861.

By Professor Willis, M.A., F.R.S., Honorary Member.

About eight years ago, on the occasion of the meeting of the Archæological Institute at Chichester, I made a minute examination of the cathedral, with which I was already tolerably familiar. My desire was to give a complete history of its architecture, not from written documents, but a history in which the stones should be made to tell as it were the story of the building. Circumstances over which I have had no control have prevented down to this time the appearance of the account I then prepared. It was intended to unite it with other architectural subjects, and they will, I understand, shortly see light, the necessary material being now in the hands of Mr. Mason, the publisher, of Chichester. Having taken so deep an interest in the cathedral, you will comprehend with what anxiety I hastened to the spot as soon as I heard of the late melancholy catastrophe, desiring to put upon record the exact circumstances attending it. Every opportunity was afforded me for obtaining the fullest information upon all points to which I directed my attention, and I have at any rate endeavoured to acquaint myself completely with the questions bearing on the causes of the failure. It is not, however, my intention now to enter into a narrative of the circumstances which have just occurred: to do so would be only to retail to you second-hand what you have the opportunity of learning directly from persons who witnessed them. I purpose rather to direct attention to the previous history of the cathedral, and to such other instances as are upon record where a similar calamity has befallen, in the hope that a consideration of examples may in some measure tend to avert for the future such lamentable events. With the late catastrophe of Chichester before us, the nature and extent of these disasters is vividly impressed upon us, and from the numerous records of the fall of similar towers which history has given we must acknowledge the importance of concerting in time for the preservation of such buildings as yet remain.

Chichester cathedral was essentially a Norman erection, and, owing to the mode of construction adopted in the Norman age, as well as to the treatment which the work afterwards received, Norman buildings have been peculiarly liable to failures of this kind. Chichester cathedral had no connection with any Saxon work, none previously existed on that site; it was, in fact, built upon virgin soil, as was the case with the cathedral at Norwich. In the year 1114 a fire occurred, which damaged the cathedral; another fire occurred about 1186, and consumed the mother church and the whole town. The re-edification was a work of great importance, and the cathedral was re-dedicated in 1199. The additions to the Norman work on this occasion belonged to what might be termed the nascent early English period, and this restoration was completed about 1204. There are evidences which show that before this re-edification the eastern end of the cathedral terminated in an apse. The aisles of the choir being continued round the apse formed a procession path. From the procession path in the centre of the east end I fancy an apsidal chapel projected, and also I should suppose there were radiating apsidal chapels both north and south of the central one opening to the procession path. The later work of the square east end and lady chapel has left but traces of the Norman features which I suggest here; their removal permitted the addition of two bays to the length of the choir, which addition was made in a purely early English style. Till now the transepts had also each been furnished with an

apsidal chapel on the east side, but after the fire of 1186 a square chapel was built in place of the apse to the south transept, and the apse to the north transept was superseded by a large building, which, because it has a central column to support the vaulting, has been supposed to have been the chapter-house, but was, in fact, a large chapel or pair of chapels, as is plainly indicated by the existing piscinæ. The central pillar is not necessarily an indication of a chapter house, and many chapter houses (York for instance) have no middle column. The re-edification upon the Norman nave and choir exhibited strongly the economy with which the Bishop and chapter applied their resources, they did not destroy the walls, though injured and thrust out of the perpendicular, but recased them at the top, where the burning roof had injured them, and also at the bottom where the fallen timbers charred them, and applied new mouldings to those parts, whilst the middle part or triforium having escaped serious disfigurement was passed over without alteration. In these repairs I have traced a curious evidence that in the Norman period the space devoted to the service of the choir extended into the three eastern bays of the nave. In those bays the facing of the walls was restored to a greater extent than in the others, which I account for on the supposition that the woodwork of the stalls being there, the effect of the conflagration on the face of the walls at the back of them, necessitated an extension of the restoration, which was not necessary elsewhere. Having thus made good the walls at the top and bottom the architects added flying buttresses on the outside as well to prevent a further decline from the perpendicular as to enable them to carry the stone vault, which important feature was now first erected, extending over the whole building. But the addition which most of all concerns us now, namely, the erection of an early English central tower upon the four Norman arches at the intersection of the nave and transepts, we must also refer to this period. With the precaution of raising discharging arches of pointed form, built solidly through the walls immediately above the four Norman arches, they carried up a massive and lofty tower, upon which in yet later times a magnificent spire was added. Obviously this placed the Norman supports of the tower in a very different condition, and in very different circumstances to what the Norman architects had contemplated. Under the increased weights the piers subsided from time to time into their foundations. This mode of failure is not peculiar to Chichester, for there are few Norman towers which do not show similar marks of an overpressed foundation. The walls or piers, moreover, were not calculated to sustain more than a very ordinary weight, for being intended in the first instance to carry nothing more than sufficient height to obtain light through the roof, their builders did not commence with much reference to great strength. There was no attempt at bonding the stones together. It is surprising how little attention was paid to this. The outside or face was a mere shell of ashlar, the interior loosely filled with rubble and mortar. Wherever we find Norman work we may look for these inherent defects. I could point to an example at Bury St. Edmund's, where when a few years ago the ashlar facing was taken down it was found to have no connexion with the centre of the walls, but merely left the impression of the facing stones in the mortar behind. At Chichester the original weakness of the tower piers and their foundations had long since permitted a subsidence, which separated the parts under the tower from the adjacent walls. Their dislocation from the walls of the nave and transepts was marked by fissures which travelled through the heads of the clerestory, triforium and ground arches abutting against the tower. The amount of the subsidence could be ascertained too with much accuracy, and the date of its occurrence within a near approximation, for where some of the early English strings were inserted in the transepts, the courses of stone against the tower piers had been so carried down, that it was necessary to put a feathered or wedge-shape course under the string four or five inches thick against the tower, tapering off to nothing eight or ten feet from it. By this contrivance the string was brought to a horizontal line, and this horizontal line again afterwards became broken, a further depression having taken place

in the tower. The original weakness of construction and subsequent dislocations account for the way in which the structure finally collapsed. The substance within the piers, long separated from the help which the adjacent parts should have afforded, began to crush, a movement which no human power could resist. The peculiar nature of it is well known, for if we crush a cylinder placed on end the upper parts will slip off in a diagonal direction, leaving a cone-like figure at the base, which was exactly the mode of failure in the Chichester piers. With this peculiar movement the fall was very gentle, resembling rather the shutting up of a telescope than the headlong fall and smash of an immense superstructure. So completely did it melt into ruin that only one mass, ten or twelve feet high, forming the western part of one of the south windows of the tower, retained anything of its form, presenting in the midst of the ruin, when uncovered, a very remarkable appearance. It settled five or six feet in a diagonal line, south-west from under where its place had been, thus showing the amount of inclination which in its fall the tower took in that direction. The share in the calamity, which is to be attributed to the tempest which raged the night before the fall, it is impossible to allot. It is more than probable that the causes to which I have already alluded were sufficient of themselves to produce the result, and the tempest merely hastened by a few hours what was inevitable. A spire presents to the action of the wind the means of powerful leverage, and the vibration to which all spires are subject, and which must have been very great in this one, would account largely for the disintegration of the fabric. Sir Christophen Wren noticed this, and in order to counteract the effect he suspended within the spire from the top stone a heavy wooden gallery, acting as a pendulum.

I now proceed to call your attention to other examples. Bad work I have already shown was known to the Mediæval builders, and we shall see that instances of it are abundant. Indeed, though I have a high respect for the feeling which moved those builders, and for the ingenuity and taste they exhibited, I am bound to say that in construction they had very little judgment and no science. We are not to suppose that the prelates of whom we hear as church builders were the architects of the buildings attributed to them. Their works were conducted by men devoted to building as an employment quite as much as the professional men of the present day, but at a great disadvantage as regards scientific knowledge.

The first Norman tower whose fall is recorded is that of Winchester cathedral. This was one of the first cathedrals erected in this country by the Normans, Bishop Walkelin, one of the first Norman bishops in England, being the founder. The tower fell very soon, and the monks asserted that the fall was caused by the wickedness of William Rufus, who had been buried under it. The present central tower was plainly erected after the fall of the original one, and is supported by four piers of great magnitude, the fate of its predecessor seems to have led to an unnecessary expenditure of material in them as their strength is greatly more than equal to the work imposed upon them. There was a curious connection between the cathedrals of Winchester and Ely, the latter was built by Simeon, brother of Bishop Walkelin, and, singularly enough, the central tower of Simeon's Cathedral at Ely fell in 1322. An account of this calamity is found in the chronicles of Ely, and the history is so curious that I shall give it you in detail from that source. It seems that when Alan de Walsyngham, a skilful architect, was made sacrist in October 1322, the tower was threatening ruin, the monks were consequently afraid to carry on the service in the choir. On the night before the feast of St. Etheldreda after they had made a procession to the shrine in her honour, and they were returning back to their dormitory, a few only of the brethren had entered their beds, when suddenly and without warning the bell-tower fell upon the choir, with so much noise and crashing that it appeared like an earthquake, but neither wounding nor crushing any person. Another

wonder happened, to be attributed to a miracle rather than to a natural cause, namely, that in that horrible ruin and collision of stones which shook the whole city of Ely, the large and beautiful canopy which covered the sepulchre of the Holy Virgin escaped even the slightest injury. At this dreadful and lamentable damage the aforesaid sacrist, sorrowful and grieving exceedingly, knew not whither to turn, or how to repair so great a ruin. But at length, taking courage, and trusting to the Divine assistance, and confiding in the Virgin Mary and the merits of St. Etheldreda, he set to work manfully. First of all he caused all the stones and timber which had fallen in that ruin to be carried out of the church, with great labour and expense. He then cleared the church of the excessive dust which covered it, (the interior of Chichester cathedral was wholly covered with a fine white dust in a most marvellous manner,) he divided the place in which the new campanile was to be built into eight parts, measured with architectural skill, and caused it to be excavated and examined to reach solid ground to commence the foundation upon which eight piers were to be erected to support the building, within which the choir and its stalls were to be constructed. These eight places having been carefully examined, and made strong with stones and sand rammed in, he began the eight piers with the work above, which was carried on for six years, and completed up to the upper stringcourse A.D. 1328. Forthwith that skilfully devised wooden structure of the new campanile, invented with marvellous ingenuity to cover the aforesaid stone-work, was commenced and carried on with great and burthensome expenses, principally incurred in seeking far and wide for beams suitable to the said structure, which, when found with great difficulty, had to be bought at a high price, carried to Ely by land and sea, and there carved and framed into the structure by skilful workmen. The wooden structure was carried on fourteen years, from 1328 to 1342. The whole cost £2,400., and was for the whole rebuilding twenty years in progress. The case is in many of its incidents parallel to Chichester, but I hope our own misfortune will be repaired in less time than that at Ely. Thus arose the celebrated octagon at Ely, and I may be permitted to recall to your memory the fact that Sir Christopher Wren was nephew to Wren, Bishop of Ely in the time of Charles I. Thus Sir Christopher had many opportunities of admiring the plan of Ely Cathedral, and when he contemplated the plan of the dome of St. Paul's, it can hardly be doubted, he was guided by the octagon of Ely. The tower of Gloucester fell about 1160, without warning, at the time when one of the bishops came to preach, and it fell when the bishop was about to deliver his solemn benediction to the congregation, who had all crowded for that purpose into the choir; thus it was so ordained that no loss of life or limb occurred at that time. The tower of Worcester Cathedral, built in 1084, fell in 1175; that of Evesham fell in 1215; the two towers of Dunstable Priory, in 1221; two small towers of Worcester in 1222; and the tower of Lincoln, in 1244. The steeple and belfry of Norwich Cathedral were blown down in 1361, when the choir was destroyed; but had since been rebuilt in its present magnificent form. The west front of Hereford fell in 1786. Passing from this melancholy list I will now advert to some instances in which the mediæval architects have discovered the impending failure in time to remedy it, and it will be highly interesting to observe the remedies they adopted.

At Wells Cathedral the central tower was erected in 1318, and so soon as 1321 the piers were found to be dreadfully crushed so as to produce the utmost anxiety for the safety of the building in the minds of the bishop and the cathedral dignitaries. Those ecclesiastics exerted all their powers to repair and avert the evil, contributing most liberally from their own means, as I am bound to say has been done at all times by the clerical bodies, and never with greater liberality than in the present instance at Chichester. The scheme adopted at Wells was this, between the piers of the arches of the

central tower they constructed in each case a low pointed arch, above that and upon it was raised an inverted pointed arch, the springing of which came up to the springing of the great arch itself, and upon the springing of the invert another erect arch was carried forming an inner ring or additional arch to the great arch itself. This scheme was scientific and perfectly effectual, the nearly solid spandrels between the low arch and the invert completely prevented any further movement inwards of the great piers, and the inner arch at the top strengthened and relieved the original arch, and gave solidity to the new abutments of the invert and small arch below. Scientific and satisfactory as the remedy was in some respects, it must be admitted that the complete severance which it makes in the cathedral is totally destructive to the internal effect, and we must hope that the scheme will not be repeated.

At Salisbury and at Canterbury another expedient was adopted, and although in the case of the latter the ancient chronicle says that it was done "by the prudent forethought of the architect," there can be no doubt that it was not thought of till after the mischief had begun. At Salisbury [built about 1258] a strut or beam of stone, formed into perpendicular tracery, was introduced between the piers under three of the tower arches at about half their height, and although the state of the work now is such as to give great cause for anxiety, the inward movement of the piers has for a long while been arrested. At Canterbury, when a similar movement commenced [the piers were built about 1400] stone traceried beams similar to those at Salisbury were erected between the piers of three of the arches, and by way of additional security similar beams were carried across the arches at the ends of aisles on each side of the western tower arch, making a complete chain of struts from the solid walls; and on each side of the nave across the first arch next the tower.

At Hereford the threatening tower was one of the faulty Norman structures. This cathedral has been peculiarly unfortunate. The fall of the west end is almost within the memory of some living. It was heavy Norman work upon which a later tower had been added, and the impending danger was foreseen for some years. The ordinary precautions were taken, and such as have been considered most effectual. Mr. Wyatt, the architect, shored it up, but it fell, as we have said, in 1786. The central tower had suffered from the decay of its supports. Evidently the piers had a tendency to burst out as they have done at last at Chichester. The architects applied a stone casing to the piers consisting of courses of upright stones three or four feet long, alternating with bonding courses of similar stones laid horizontally, hooping round the piers, making in fact a jacketing of stone very similar to that proposed to have been applied in timber to the Chichester piers. The next measure adopted at Hereford was a most extraordinary one; under the north and south arches in the centre of each a pier was erected, dividing each arch as it were into two, the pier rising nearly to the top of the great arch and then spreading out a little so as to give something of an arched form to the spaces at its sides, and thus rising up to the crown of the great arch. But this part of the great arch is just where support was not wanted, where in fact any effect that the new pier did exercise must be prejudicial, for if it should prevent any declension at the crown of the great arch, the lower part of the arch relieved of its weight would become loose and the stones fall out, and it would not in any way hinder the weight at the corners of the tower from continuing to press down and crush the Norman piers. These very Norman piers have, in still more recent times, created alarm. Mr. Cottingham shored them up and secured the tower for a time. His success so far was great, though he had the advantage of having no spire to carry. The construction of the upper part of this tower added by the Mediæval architects upon the Norman piers is very remarkable as seen inside. Each wall is made to consist of a series of upright piers forming a sort of gridiron erect, as though it had been anticipated that

it would be necessary for the different parts of the wall to settle and slide past one another independently.

With all these cases before me, and after what I have seen at Chichester, I have no hesitation in saying that the piers there had arrived at such a state of disintegration that they must have fallen. It is absurd to suppose that the removal of the Arundel shrine could have caused the catastrophe. It was merely a screen only 15 feet high, and was not able to oppose any perceptible resistance to the weight of the tower. The fall was so to speak providential, and it is matter for great gratification that after hanging over the congregations for years in a state of peril it had come down without entailing loss of life or limb. I do not say that in some respects the remedies adopted may not have hastened the calamity. No one can assert that the vibration of axes and hammers and of a body of workmen may not have exercised some ill effect, but this was necessary to any attempt to save the tower.

There are other cathedrals certainly in a very precarious condition. The piers under the spire at Salisbury are trembling with their load, and the west front of Ely is very far from being in safe condition. It is, therefore, a pressing question for architects and engineers to consider what can be done in such cases. If my remarks should lead the profession and the public to consider upon the necessary steps to be taken when these disasters threaten, my purpose in drawing attention to the catastrophe at Chichester will be fully realised. A careful consideration of the subject would be the means of accumulating a vast mass of useful information for the guidance of ourselves and our successors.

Mr. A. J. B. Beresford Hope, Hon. Fellow, moved a vote of thanks to Professor Willis for his erudite and eloquent lecture. He also rose to express a feeling of personal relief which the statements of Professor Willis afforded him. As a member of a small committee entrusted with the restoration of the choir in memory of the late Dean Chandler, he was one of the persons directly responsible for the removal of the jube, commonly called the Arundel screen or shrine. The removal of that screen was a necessary element in the plan they were carrying out for fitting the nave for a congregation and opening the choir to it. The committee were quite incapable of wantonly destroying an ancient monument; but if the use and intention of their alterations were considered it was evident that without the removal of the screen their plan could not be carried out. This was the view of the committee, and Mr. Slater, their architect, agreed with them that there was no other alternative, and thought that the screen could be done away with. Still, so anxious were the committee to stand well with the public in reference to the matter that they decided in the absence of Mr. Slater to take a second opinion, that of an engineer who should look at the tower as he would at a railway bridge without any bias from antiquarian feeling, from ideas of ritualism or questions of architectural taste, but who would regard it merely as a question of strength. Thus, Mr. Yarrow, an eminent engineer, was called in, and he reported that the screen in no way affected the stability of the tower, and it was accordingly removed. These facts he thought ought to be known as extensively as possible, as owing to some want of information those concerned in the work of restoration had been made the victims of unfair aspersions in some quarters. The statement he had submitted showed the caution with which the proceedings had been conducted, and what they had heard from Professor Willis proved that the calamity was one which no human foresight could have prevented. He thanked the professor for the manly and candid manner in which he had stated his view of the subject, and felt assured the meeting would concur with him in the vote he had proposed, for the

clear light the lecturer had thrown on the history of architectural science and enterprise during the long centuries in which our cathedrals arose.

Mr. Edmund Sharpe, M.A., Fellow, seconded the motion. He was the person to whom the professor had adverted in the opening of his lecture as being in some degree responsible for the delay which had taken place in laying before the public the book containing Professor Willis's history of Chichester Cathedral. He had in fact undertaken a much more laborious task than the two other contributors to the compilation of that volume. It had, however, now been decided to produce the three architectural histories originally contemplated, and to omit the architectural catalogue of the churches of the diocese, which had been added to his subject, but had proved too laborious an addition to accomplish. On this evening, he had thought that some further illustration of the history of the cathedral by reference to the chronological series of its mouldings, of which he had prepared careful drawings, would be interesting. He must, however, for want of time, postpone that to a future occasion, and content himself with expressing a hope that a restoration in strict conformity with the old work would be carried out with a careful attention to these details.

Mr. Alfred Thompson, C.E., Visitor, stated that he had examined the stone from the ashlar and responds of the tower piers of Chichester cathedral. He found it to be a shelly limestone, brought, as he was informed, from the Isle of Wight. It is nearly a pure carbonate of lime, of a very light, porous, and absorbent character, the specific gravity of the stone being only 1.815. He handed to the chairman a slab, one-fourth of an inch thick, sawn from the stone, through which light passed in numberless places. He had made experiments as to its crushing weight, and found that, when laid in its bed, it crushed with a weight varying from 466 lbs. to 566 lbs. per square inch, but, when placed vertically to the bed, it sustained a weight of 860 lbs. to 1,070 lbs. per square inch before it crushed. In the first instance the stone crumbled into powder, but, when placed vertically, it split diagonally, in the manner described by Professor Willis. Mr. Thompson accounted for the increased strength of the stone, when placed vertically, by supposing that the layers of shells formed long, flat, and thin arches on its bed, but, when reversed, the layers became either laminated columns or narrow lancet arches. The area of one of the tower piers, as calculated by him, was 10,140 square inches, and, as the tower and spire had been reckoned at a weight of 6,000 tons, it followed that 1,500 tons, bearing on each pier, gave a superincumbent weight of 331 lbs. per square inch of surface. Now, as the piers were only cased with the stone laid in its bed (which crushes with a weight of 466 lbs. per square inch), and the interior was a mass of rubble stone, filled in with mortar in large lumps, some of it in a crumbling state, it appeared to him not surprising that the spire should have fallen down, but that it should have stood so long on such weak piers, and he considered that the early settlements which had been mentioned were as much due to the crushing of the stone as to the sinking of the foundations, from the excess of weight placed on them.

Mr. M. D. Wyatt, Fellow, asked upon what scale were the experiments that had been made.

Mr. Thompson said they were made with inch cubes of stone so as to compare them with others.

Mr. Burnell observed that with regard to measures which might have to be taken for the preservation of these buildings for the future, the subject was one that would require considerable attention. Lately some important works had been carried out in France, and a cathedral tower had been underpinned with remarkable success. If a similar principle had been adopted at Chichester he believed the spire might have been preserved. If the discussion was to be adjourned he would endeavour to collect all the information in his power on the subject, and put it into a connected shape.

The Chairman said there could be no question as to the desirability of obtaining such information, and the council would have great pleasure in appointing as early an evening as they could, consistently with other arrangements.

Mr. Morris, Associate, thought it desirable after what had passed, that those gentlemen who had been connected with the work of restoration should be exonerated from all responsibility in respect of the recent catastrophe. In his opinion the pendulum which Sir Christopher Wren affixed to the spire was sufficient by its vibration to account for the fall.

Mr. J. W. Papworth, Fellow, inquired in what manner the piers had moved during the fall.

Mr. Gordon Hills, Associate, said the body of the tower above moved five or six feet to the south-west in its fall. This arose from the mode in which the south-west pier failed, it had exhibited a tendency to bend outwards in that direction at two thirds of its height, and on the last day of its existence it threatened to burst out all round at four feet from the ground. The north-west pier was bursting in the same manner near the bottom, and the top of the pier was split in all directions, these two piers were now utterly lost, and he suspected that when the ruins were cleared away not more than four feet in height would be found of them. The two eastern piers cracked and broke up in the upper part, and in the fall this portion slipped off, leaving about twenty-five to thirty feet high of the piers standing, the top of the stumps where the broken work came off sloping steeply to the westward.

The Chairman, in putting the vote of thanks, remarked on the complete refutation which Professor Willis's lecture afforded to the unfair aspersions referred to by Mr. Hope, and the resolution was then carried unanimously.

ON THE ARCHITECTURAL ACCESSORIES OF MONUMENTAL SCULPTURE.

By F. Pepys Cockerell, Associate.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, April 22, 1861.

The subject of "The Architectural Accessories of Monumental Sculpture" embraces so wide a field of research, and the line to be drawn between architectural accessories of sculpture, and sculpturesque accessories of architecture, is in many instances so little defined, that to draw that line, and to sketch, even superficially, the leading features of the whole subject, would be matter for a volume. The narrowness of the limits of one evening's paper, therefore, constitutes in itself an apology for its incompleteness. All that can be done is to point to a few examples of the ancient schools, and where the actual examples are wanting, to quote the authority of those who, from the obscure hints of ancient historians, have brought to light some of their principles of art. And if we compare with the few examples that remain the efforts of our modern schools (our own especially), we shall find that, obvious as these principles may appear, they have been sadly misunderstood, and too often utterly ignored by our artists. Perhaps the fault will be found to exist, not so much in the want of talent in these times, as in the spirit of utilitarianism, which, by insisting on the union of the artist and the tradesman in the same person, limits the artist to a single branch of art, and practically ignores that union of the three sisters in which alone true strength in art can be found.

Taking as an axiom that the object of a pedestal is to give dignity and importance to the group or figure which it supports, rather than to act as an architectural feature having a primary importance and interest of its own, our first desire in studying the subject is to find some fixed principle of design and rule of proportion to guide us in our combinations, such as are found to exist more or less positively in the *architecture* of every school. But if in the study of the present subject we turn to architecture, it seems at first sight to offer but little assistance; for when once we have established that the object of a pedestal is to give importance to the feature which it supports, the analogy in the application of the pedestal in the two arts seems to stop; for the precise and geometrical lines, and the spirit of line and rule which constitute the essence of architecture, have nothing in common with the flow of line—the ever varying, and as it were accidental forms of sculpture. Yet though it may not be possible to establish a direct and palpable parallel, or to apply the rules which govern the proportion and form of architectural pedestals to those of sculpture, still the spirit which pervades one branch of art will be found to exist in the coeval works of the sister art, and a thorough acquaintance with the one cannot fail materially to assist us in our study of the other.

If we compare the few remaining examples of architectural and sculpturesque pedestals in the antique schools, there will be found a coincidence of principle in each school which will afford reasonable ground for adopting the architectural principle, where examples of the other are wanting. We cannot enough regret the scarcity of authentic information on the subject of Greek pedestals, but such hints as are afforded by written descriptions and the paintings upon vases, &c., should be regarded as the Sybilline books and turned to account as best we may. It is no platitude to repeat that the Greek school is that from which all that is good in art is derived more or less directly; it is that which beyond all others evinces the deepest thought and the most unerring principle, and which is least subject to that

caprice which so frequently bewilders us and throws us off our scent in modern schools. Horace, in the often-quoted passage,—

"Exemplaria Græca
Nocturnâ versate manu versate diurnâ,"

says only what scores of writers and artists of all times have said or implied, if not with the same eloquence, with equal insistance.

Of the earliest style of art but little need be said, for though the monumental sculpture of the primitive schools of Greece (commonly called the Dædalian School) and of Egypt, has great and peculiar qualities of its own, they are not such as will materially tend to illustrate the subject under consideration. It is not unworthy of remark, however, that the coincidence between the works of architecture and sculpture which we shall find in other schools, exhibits itself also in the primitive works by the fewness of parts and the almost entire absence of those accessory features (as the pedestal) which are used in other schools to give scale and dignity to the leading features, and which the massiveness of the forms in the earlier schools seems to render less necessary. In the Egyptian and Assyrian architecture the columns generally stand upon the ground, or where they are raised upon a stylobate (as for example in the small temple at Philoe, commonly called the bed of Pharaoh,) the latter is of a height which gives it rather the importance of a leading feature than an accessory. The pedestal, properly so called, belongs altogether to a later and more complete style of art, and seems a natural step in the development as well of sculpturesque as of architectural composition. Even with the Greeks this feature is but rudimentarily treated in the earlier works, the stylobate of three steps (κρηπιδωμοσ) being the only approach to the idea of a pedestal until the introduction of the Ionic order. The temple of the giants at Agrigentum is the only example that I am aware of in which a base is applied to the Doric order. This, and a greater number of steps in the stylobate, seems to show a marked progress in the development of the principle involved in the use of the pedestal. As in the earlier architecture so in the sculpture, there is an entire absence of what may properly be called a pedestal. The sphinxes of the sacred way at Philoe have only a low square plinth, without architectural features of any kind. The colossi of the Plain of Thebes, of the rock-cut temple of Ibsamboul, and many other examples, are treated in the same way. It should be observed, however, that in none of these examples is the secret of scale, namely, the subordination of parts and gradation of dimension, entirely omitted, though it is not applied by means of *architectural* accessories. The colossi are surrounded by smaller figures of nymphs and divinities, and the sphinxes and caryatid figures have hieroglyphics and incised ornaments upon the square plinths which assist materially in giving importance to the principal object.

Of Archaic Greek sculpture of monumental scale and character but very few examples exist. The sitting statues of the sacred way at Branchidoe, one of which is in the British Museum; those cut in the rock at Palazzuolo—the ancient Acroe in Sicily, and a colossal lion, also cut in the rock, at Naxos, are some of the examples that I can quote. Pausanias mentions and gives descriptions of several, which it would be foreign to our subject to refer to. These are very similar to the Egyptian sculpture and are evidently derived from it, and they always exhibit the same absence of architectural accessories. There are many small statuettes of the Dædalian school, which were no doubt in many cases copies of colossal statues, and were used as votive offerings. Their pedestals (if any) have not been preserved. One of the volumes of sculpture published by the Dilettanti Society gives an example of a statuette of Minerva of this character, which has a pedestal. This is clearly a copy of a colossal statuette, but it is highly probable that the pedestal may have been added to the original statue in later times, as in the case of the Apollo of Amyclœ and in other instances.

Having thus briefly noticed the earlier practice, and the absence of the feature which forms the substance matter of our consideration, we now come at once to the great times of art when sculpture had reached its highest development, and when, as we may naturally suppose, the architectural accessories had reached the same pitch of perfection. It must be a matter of great regret that the sources of information upon this subject are so few, and that of the thousands of statues which adorned Athens and the other great cities of Greece, none of the pedestals remain; so that the scanty descriptions given by Pausanias, Pliny, and other writers, and the conventional representations on vases, are the only sources of information. We may, however, derive some assistance in developing these scanty hints from the architectural pedestals of the period.

The school from which our modern practice is chiefly derived, if indeed it can be said to be derived from any school at all, is the Roman; a mere vulgarised imitation of the Greek, in which the substance is copied but faintly and the spirit not at all.

In looking through the examples of Greek architecture in which the pedestal occurs, one is struck first with the relative importance of the dimension of the column to that of the pedestal, in which such a marked difference from the Roman appears. In the Greek the pedestal never exceeds the height of the entablature, and is more generally about one-sixth of the height of the column, while in the Roman the proportion is usually not less than one-fourth. There are some examples of Roman architecture in which the Greek system has been adopted, as in the temples at Assisi and at Pola, and in the building called the Incantada, at Salonica. In the latter the pedestal is less than one-eighth of the height of the column; but these are exceptions to the Roman rule. The loftiness of the Roman street architecture appears to have rendered it necessary to elevate the order in public buildings and temples upon a higher pedestal, so as to give it a proper importance in relation to the surrounding houses. This necessity would hardly be felt in the same degree by the Greeks in their less crowded spaces. A second and not less important characteristic of the Greek pedestal is, that the width of die is not much larger than the diameter of column itself (namely, about one-sixth of its height); while in the Roman the width is equal to that of the base of the column. Thirdly, the Greek die commonly diminishes upwards, thus preserving in the pedestal the character which the entasis gives to the column, and as it were uniting the pedestal and column in one composition, and avoiding the apparent break in the line which is so observable in the Roman. Fourthly, the small dimension of the pedestal causes the cap and base mouldings to assume an importance which they have not in the Roman (without the actual size of the mouldings in reference to the column being increased), thereby imparting a rich and composite character which, while adding to the mass, affords a valuable contrast by its horizontal lines to the vertical lines of the column.

In the Italian revival the Roman exaggeration of the pedestal was carried still further, until it became necessary to give such a development to the capping that it assumed the importance of a complete cornice, with bed mould, corona and cymatium, instead of the simple moulding used by the Greeks. Thus the pedestal might almost be said to have ceased to be a part of the order incorporated with it and forming merely a base to it, and to have become a separate feature with an importance entirely its own. The Taylor and Randolph Institution, at Oxford, affords an example of the low pedestal used by the Greeks. Those who are acquainted with that building will hardly fail to recognize the beauty of this feature.

Of sculpturesque pedestals of the Roman school a sufficient number of examples remain to trace the presence of the same defects which characterise the architectural pedestal. It will therefore not be an unwarrantable assumption to suppose that the same affinity between architecture and sculpture existed in the Greek, and the very scanty information which we have seems to confirm this supposition.

Thus much for the elementary principle of form and proportion *per se* independently of the very important subject of the application of it to the various conditions of small, life-size, and colossal statues, which the small space of this paper will allow us to treat but superficially.

The next and most important principle which we have to consider, is the giving of scale to the principal object by the introduction of ornamental and sculpturesque detail in the pedestal. *The* PRINCIPLE *involved in this practice* is, as we have observed, not forgotten in the earlier works of sculpture, but it is applied to the sculpture itself and not to the pedestal (there being none to apply it to). The advantage of its application to the pedestal instead of the principal object is obvious. There seems to be an irrationality in grouping together giants and pigmies in one composition, as in the rock-cut temple of Ibsamboul, and many other examples, where a small figure stands by the legs of a large one. One accepts the expedient as one of necessity, and its grotesqueness is rendered less prominent by the conventional character of the whole work; but where the same thing occurs in later and more perfect works, as in the Toro Farnese at Naples, and the Nile God in the Vatican, one is at once struck with a sense of disproportion, and one is disposed to question whether a better means of giving scale might not have been used. There are not wanting those even who question the propriety of making the sons of Laocoon so much smaller than himself. When, however, the smaller figures are contained within the lines of an architectural form, and are subordinate to it, forming its enrichment only, they cease to come in competition with the statue and only act as a foil. They are then no longer of the same nature with the statue. The fact of their forming a part of the architecture conventionalizes them and renders them inanimate things, stone or metal, while the statue represents a living creature. Quatremère de Quincy, in speaking of the Victory in the hand of the Olympian Jupiter at Elis, says: "There is no comparison to be established between the victories placed in the hands of statues and the statues themselves. The figures of Victory in question, if one considers the usual conventions in this sort of composition, play the part only of images and not of living beings." The greatest examples of the importance of the principle which we are now considering, namely, that of gradation, are the works of Phidias, the Chryselephantine statues of Jupiter of Elis, of Minerva at Athens, and many others.* In these statues the smaller figures were not confined to the pedestal, but were introduced in every available space. The throne of the sitting figures, the shield of the Minerva, even her very sandals (on the edge) were covered with subjects; but these are mostly in basso relievo, and in those parts where it is supposed that complete figures were introduced, they formed part of some conventional object, as griffins subduing Greeks, which supported the arms of the throne. I find in Q. de Quincy an observation upon the importance which Phidias must have attached to the pedestal. He says: "We may conclude from a passage of the orator Themistecis, that the bassi-relievi of the pedestal occupied Phidias a long time. Although this artist says he had great ability in the art of representing in gold and ivory the figures of men and gods, nevertheless he required much time and leisure to finish these works. It is reported, indeed, that in the execution of Minerva he employed a considerable space of time in the works of the pedestal of the goddess." Pliny particularly dwells upon this fact. He says: "Among all nations which the fame of the Olympian Jupiter has reached, Phidias is looked upon, beyond doubt, as the most famous of artists. But to let those who have never seen his works know how deservedly he is esteemed, we will take this opportunity of adducing a few slight proofs of the genius

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* Minerva of Pellene; Minerva Polias; Minerva of Lemnos, said to be his best work; bronze Apollo, in the Acropolis of Athens; Minerva of Platea, in marble and gilt wood; Venus Urania, in the temple of that name; The Mother of the Gods, in the Metroum of the Ceramic; Minerva Hygeia, in bronze, on a gilt throne; Venus Celestis, at Elis; Minerva Ergané, in the Citadel of Elis; and the Jupiter at Olympia.

which he displayed. In doing this, we shall not appeal to the beauty of his Olympian Jupiter, nor yet to the vast proportions of his Athenian Minerva, twenty-six cubits in height, and composed of ivory and gold; but it is to the shield of this vast statue that we shall direct attention, upon the convex face of which he has chased a combat of the Amazons, whilst upon the concave side of it he has represented the battle between the gods and the giants. Upon the sandals, again, we see the wars of the Lapithæ and Centaurs, so careful has he been to fill up every smallest part of his work with some proof or other of his artistic skill. To the story chased upon the pedestal of the statue the name of the birth of Pandora has been given; and the figures of the assisting gods to be seen upon it are no fewer than twenty in number."

These statues are briefly described by Pausanias and Pliny, and they have been further illustrated by the learned and intelligent researches of M. Quatremère de Quincy. It will be sufficient to quote what he says about the pedestal of the Minerva of the Parthenon. He illustrates several others very fully, as the Jupiter of Elis, the Apollo at Amycloe, &c. &c., but we shall more readily realize that of the Minerva, knowing, as every one does, the copy of that statue in the Studii at Naples, and that at Deepdene. In describing the statue, he says: "Her height, according to Pliny, was 26 brachia, or 37 feet French (about 40 English), without including the base, of which I shall speak in its place, and to which, as we shall see, it is not possible to give less than 8 or 10 feet; consequently the whole must have been about 45 feet (French), a height perfectly in accordance with that of the Naos, which, as we shall see, could not have been much more than 50 feet (French), if we suppose the ceiling to have been horizontal." He says further on: "The height results necessarily from the two data which we possess, viz., the height of the temple, and that of the statue. Now we have shown that this height could not exceed 10 feet for the pedestal, a proportion perfectly in accordance with the method followed by the ancients in the relation of statues to their bases in the class of colossal sculpture in question," namely, that which is seen only from a limited distance. He again quotes Pliny, who says: "On the base is engraved (gravé) what Phidias called the birth of Pandora; one sees in it the birth (generation) of twenty divinities." He then goes on to show that, taking 6 of the 10 feet for the figures, and appropriating the other 4 to the capping and base, there must have been two rows of figures, as there would not be room for the whole number if they were of a size to occupy the whole height of 6 feet. "As to the division of the bas reliefs into two rows, one over the other," says he, "I could, if necessary, quote a great number of examples in the antique." Having thus determined the height, it is evident that the width of the pedestal could not have been less than 18 feet, considering the expanse that must have been given to the lower part of the figure by the shield, the griffin and the serpent.

If we restore in imagination these and other examples of which Pausanias and Pliny give descriptions, we shall find in them an illustration of what we constantly hear of and never see, namely, perfect simplicity and unity, together with the greatest amount of richness and interest. In these the natural union of the arts of architecture and sculpture is most completely carried out, each preserving its own character, while, by the due relation of the one to the other, they combine in perfect harmony in one homogeneous composition. So soon as we turn from the Greek to subsequent schools, we find this quality of unity gradually disappearing; the architectural element dwindling away, and giving place to an exuberance of sculpture and ornament. The first step in this direction is the general substitution of alto for basso relievo in the Roman pedestals.* Of this there are abundant examples; for instance, a pedestal in the Studii at Naples, with figures of cities, which I believe formed the base of a statue of Titus; that in the Vatican Garden, and many other examples.

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* For proof of the use of basso by the Greeks, see quotation from Pliny, above.

In the Gothic, I am not aware of any examples of monumental sculpture not forming part of an architectural composition (except Calvaries); but in general we find that the due relation between architecture and sculpture is almost entirely lost sight of, as in the porches of cathedrals, &c., where it is difficult to say whether the sculpture is made for the architecture or the architecture for the sculpture. Richness seems to be the object aimed at; the result obtained is profusion, not to say confusion. (I would not, however, be understood to disparage Gothic sculpture, which I have studied and drawn most reverentially, and in which I find inestimable beauties which belong entirely to itself. I am only speaking, as my subject requires, of the scientific relation of one art to the other.) In the revival, the Greek principle is recognized, though not so generally carried out. There are no doubt abundant instances of pedestals in which the relation of the architecture to the sculpture is well preserved, but in general, where richness and effect were sought, it was at the expense of the architectural element, while the monument, instead of being a statue or group, became a complete family, in which the accessory figures were scarcely subordinate to the principal, and the architectural part was merely something for them to sit upon. In the composition of tombs this prodigality is carried still further. One constantly finds little figures, mere dolls, each with its little niche, and each as complete in all its parts as the principal figure. No doubt the object sought, of giving importance to the principal figure, is obtained, but it is at the expense of the small figures, which appear insignificant, instead of preserving their own dignity while adding to that of the whole.

One of the most practically important points to consider in this subject is the difference of relative scale between the pedestal and its statue in the different conditions of small statues or statuettes, colossal statues and life-size statues.* The latter case, again, is subject to a great variety of conditions, as the public statue in an open space, the memorial statue of less dimension in cathedral or hall, and the statue placed as an ornament in a gallery. Each of these conditions being so different from the other, and each again being subject to so many other conditions of its own, it would be impossible to attempt any rule which should be of general application. It is obvious that the smaller the statue the greater will be the necessary relative height of the pedestal, in order that it may be in some degree raised out of the way of harm and placed fairly in view. It is not necessary to speak of small statuettes for ornamental purposes, as in such objects which do not aspire to be ornamental, any caprice is more or less admissible. The subject of pedestals appropriate to a statue of a height of 3 or 4 feet is one which comes more daily under our notice; but where the statue is placed upon the level of the eye and the whole of the pedestal is below it, the detail is a matter of little importance, and the proportion is all we have to consider. In the paintings upon Greek vases there are two distinct classes of pedestals represented for small statues. Those of 3 or 4 feet high are generally placed upon a low square pedestal of about the same height as the statue. A subject frequently represented, and in which this occurs, is the Family of Priam taking refuge at the Altar at the Sack of Troy, and also Diomed carrying away a Statue from the Altar. It cannot be said that the proportion is a particularly agreeable one, and one must suppose that the comparatively large surface of the top of the pedestal was intended for the convenience of placing votive offerings, and that it was rather an altar than a pedestal. The other class of pedestal is the Stylé, a small square column 6 or 7 diameters high, and of about the height of the human figure (more or less). Sometimes it takes the form of a small Doric or Ionic column, and this, again, is sometimes placed upon a plinth or pedestal. This form of pedestal seems only to be

* The expression "life-size" must be taken to mean something more than life-size, this varying according to condition of situation.

applied to small images, a foot or 18 inches high. This principle appears to be most suitable to its purpose, and is, indeed, that which in modern times is most frequently adopted for busts and small groups or statues. The form, however, which is generally adopted, namely, a shaft, without moulding or finish of any sort, and not diminishing, is not a very happy application of the principle. The simple hints given by the Greek vases are well worthy of attention.

Of the pedestals of colossal statues for exterior positions I have not been able to find any very reliable examples. What little information I have been able to gather, however, seems to show that it was low in proportion to the height of the statue. A coin of Athens, given in Millin (Galerie Mythologique), and also in Professor Donaldson's recent learned work, "Architectura Numismatica," representing the Acropolis of Athens, shows the statue of Minerva Polias. Of course in a conventional representation on so small a scale, it is impossible to depend upon the exactness of the proportion; but it is sufficient to show that the pedestal is not only low but also very narrow in reference to the bulk of the figure. The restoration given in Quatremère de Quincy of the statue of Apollo at Amyclæ, the pedestal of which was of the time of Phidias or thereabouts, shows the same peculiarity. The remarkable coincidence between these examples and many examples in architecture of the smallness of the pedestal, seems to confirm the supposition that the pedestal of colossal statues was generally small in bulk compared to the base or lower part of the statue, which must almost have appeared to overhang the die of the pedestal. In the best works of the revival we find the same character. Many examples in Italy are familiar to everyone: the colossal Angel on the top of Castel S. Angelo; the colossi of David, by Michael Angelo, and that of Hercules and Caco; the statue of Marcus Aurelius at the Capitol, &c., are all examples of this in a greater or less degree. This principle is remarkably illustrated in the Perseus of Benvenuto Cellini, but the exuberance of ornament in the pedestal deprives it of the simplicity and unity which we find in the Greek. The importance which it gives to the statue, however, must, I think, strike everyone. These, however, are but pigmies compared with the colossal statues of the ancients, the only things which approach to which in modern times are the statues of Bavaria, at Munich, and of S. Carlo Borromeo at the Lago Maggiore. With the latter I am not acquainted. That of Bavaria affords, by contrast, an excellent illustration of the merit of the Greek principle. The height of the pedestal is rather more than one-third of the statue, and the width equal to the height. Thus the bulk is so considerable that, when near the monument, one sees nothing but the pedestal, which at a distance, the statue, having no preponderating relation to it, does not serve to give scale as an object of comparison. This defect is no doubt met by the contrast of the portico, consisting of a small Doric order which surrounds three sides of the figure, and from most points of view forms a background to it. There are, however, necessarily points of view in which the eye does not embrace the monument and its background at once. In these aspects one cannot fail to be struck with the want of detail in the pedestal, which, having no features except the capping and base and a moulded panel in the die, seems by its size to diminish rather than to give scale to the statue.

In the best examples of equestrian statues the pedestals are also generally small (relatively), though the proportion must naturally be influenced to a certain extent by the actual dimension of the statue. The pedestal of Marcus Aurelius, in the Capitol, is not so high as the horse's shoulder; those of Castor and Pollux, at the top of the steps of the Capitol, are scarcely higher; that of the equestrian statue of the Grand Duke, in the Piazza Granduca, at Florence, is still smaller: many other instances might be quoted. But on the other hand, instances of the opposite system are not unfrequent. The statues of Bartolomeo Colleone, in the Campo S. Zani Polo in Venice; that of Gatta Melata, in front of the Santo at Padua, and King Charles, at Charing Cross, all have pedestals of a very tall proportion. The necessity for reducing the bulk of the pedestals of equestrian statues seems to have been universally

felt. This has been done, in most cases, by breaking the pedestal in its length and making the ends semicircular on plan, by this means preserving such a length as shall be in accordance with the impression of motion inseparable from a horse. In the crowded streets of modern cities, a statue placed upon a pedestal of so low a proportion as some of those quoted would be lost, unless the statue itself were of colossal size. This difficulty has been admirably met in several of the compositions of Rauch, in which the pedestal itself being small is raised upon a plinth, which is in some cases again subdivided or elevated upon a stylobate of steps; thus the barrenness of the long unbroken line so constantly adopted in our own statues is avoided. The moulded capping and base and other enrichments have a rich and full proportion in reference to the die of the pedestal, without the exaggeration of actual size which becomes necessary in the large pedestals so commonly in use. Thus the outline of the pedestal, rich in itself without crudely salient features, combines harmoniously with the statue, and with it engages the eye; so that the plinth or podium below, being of the most simple and severe form, may be raised or lowered without materially affecting the composition of the principal object. We must suppose that it is this difficulty of the unavoidable prominence of the capping in large pedestals which has offuscated the genius of some of our own sculptors, and driven them to the disastrous expedient of dispensing with all moulding in their pedestals* and placing their statues upon the chopping blocks which offend our eyes in too many of our public places. It is not so easy to find a reason for the prodigious bulk of some of them, which are large enough to admit of a house being built upon them over the statue's head. I have not been able to discover the authority for the rapid diminution of the block sometimes adopted, which gives to the pedestal the character of a truncated pyramid; neither is the advantage of it at once patent. Much might be said upon the subject of London pedestals, but such has been the neglect of this accessory of monumental art that there would be but little room for favourable criticism. Our sculptors can scarcely be aware how much of the undiscriminating though deserved abuse levelled at many recent public monuments is due to the entire absence of design and proportion in the pedestals. We must suppose that they do not attach the same importance to the subject as architects do. If they did, some knowledge of architectural detail, and a more careful attention to the examples exhibited by the revival schools and the more recent works of some other countries (Prussia in particular), would save our public monuments from many a deserved reproach. In these days of hero-worship, when so many statues are springing up, the subject is one of daily increasing importance, and calls for a unity between the sister branches of architecture and sculpture, through their professors, to avert the torrents of abuse which, rightly or wrongly, are poured upon each new monument.

The President said he thought they were indebted to the lecturer for the hints which he had thrown out on the subject of monumental sculpture, for, undoubtedly, most extraordinary liberties had been taken of late years with that department of art. Now-a-days, in designing pedestals there appeared to be little or no reference to the human figure,—no corresponding scale to work by, and, in fact, no regard to those canons of art which made the statuary of the ancients renowned for all time. He thought it would be well if the sculptors and the architects could form an alliance, so that the latter might impart to the former some knowledge of the antique. The sculptors, on the other hand, might possibly rebuke this presumption by telling the architects that they could give

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* There is a moulding which, though unknown to architects, is in frequent use as a base moulding in these monuments. It resembles a reversed echinus, and is, as I am credibly informed, called a thumb-moulding. The name, at least, has the merit of being in unity with the principle of design employed in the rest of the pedestal.

them better ideas for their buildings. For his own part he could only say that he would be very much obliged to the sculptors if they would do so. The lecturer had pointed out in appropriate terms the direction in which they were to look for their examples, but he regretted that he had not been able to supply them with a greater number of drawings.

Professor DONALDSON, V.P., wished to offer a few observations upon the careful and judicious manner in which the lecturer had introduced his subject. It was pleasant to find a young architect so thoughtful in a portion of his profession, which in many instances, was neglected or overlooked. He thought, however, that Mr. Cockerell had hardly done justice to the architects when he said that they held, as it were, aloof from the sculptors, while in ancient times architecture and sculpture went hand in hand. He (Professor Donaldson) believed, on the contrary, that the architect and the sculptor were on the most friendly terms, but that in practice it would be found that, whenever the architect made provision for the works of the sculptor, the first thing the patron or the employer did was to wipe out sculpture as a piece of extravagance, which it was perfectly idle to dwell upon. As an illustration of this remark he might state that he had accompanied his friend M. Le Sueur to the British Museum, where it at once struck them, in looking at the façade, that the idea of the architect had not been carried out. There were at either side great pedestals empty, upon which our Shakspeares, our Miltons, or our Newtons ought to stand. If a similar building had been constructed in France, this important feature would not have been neglected; but in England, the fact was that the architect was invariably overruled. Were it not for this drawback, architecture and sculpture would both be vindicated in our public buildings. Another subject referred to by Mr. F. P. Cockerell attracted his attention: it was the observation (if he had not misunderstood him) that, in his opinion, the laws of architecture and sculpture could not be reconciled. In this opinion he (Professor Donaldson) could not agree, because he believed that all the arts could be reconciled. Look, for instance, at one of the photographs exhibited that evening, the Fountain at Nismes. He had seen it, and he had always regarded it with the greatest admiration. It was a most beautiful work, and he had merely to point to the photograph of it to ask whether there were not mathematical points and lines about it showing that it was subject to the laws which governed architecture. There would be perceived in it the same triangular form as was found in architecture: and it was, he submitted, an illustration of the truth of the dictum, that the same laws, which applied to architecture, also applied to sculpture. This was especially evident in the works of the Mediæval architects, who introduced sculpture with such power and propriety of feeling, that it combined with, and seemed to be part of, the architecture itself. If they looked to the canopies and pedestals of Mediæval sculpture, they might find the statue to overhang the pedestal, but they would harmonize well with the whole composition. Whether the pedestal of a statue were large or small, would depend not so much upon the statue itself, as upon its position and the surrounding objects. Thus the statue of Marcus Aurelius might require a pedestal under the pedestal if it were placed in another locality. The statue of Frederick the Great, at Berlin (a photograph of which was before them), required a large pedestal to set it off, and give it dignity and importance. So with the statue of Charles I., at Charing Cross, if the pedestal were not high, the figure would be among the cabs and omnibuses, and nobody would see it. While he was upon this subject, he might remark, that, upon going up Portland Place the other day, he could not but feel great regret to see the statue of the Duke of Kent placed as it was. It was erected to the memory of a prince whom the English people loved, and it was dearer to them now, that it represented the father of their Queen. But it was a disgrace both to the public and to the Board of Works (responsible as they were for the national monuments), that a proper pedestal was not provided for it. The statue of George III., which was a very fine one, looks well in its present position, but if it had been placed on the pedestal where

the statue of George IV. stands, it would not have done at all. He held it to be a maxim in these matters, that in selecting a pedestal, it was less important to consider the statue itself, than the position which it was to occupy. Care, however, should be taken that the statue should not crush the pedestal, nor the pedestal be too heavy for the statue. Mr. Cockerell had not referred in his interesting paper to the statue at the foot of the Acropolis, at Athens, in the drawing of the restoration of which, made for the Royal Academy by Sir Robert Smirke, that gentleman had introduced a corresponding pedestal at the other side. With regard to the colossal statues at Athens and other places, his impression was that the idea had been taken from the colossal statues in Egypt. The Greeks, it was well known, sent their ambassadors, their students, and their great men to Egypt. There the mighty statues struck them, and they determined to introduce them into their own sculpture. This might account for the remains of colossal statues in Athens and other parts of Greece. The lecturer had referred to the practice, in some cases, of putting blocks under pedestals. It always occurred to him, that a pedestal without a moulding always looked unsatisfactory, as it presented a monotony of outline displeasing to the educated eye. In his opinion, too, a pedestal without a cornice was an impropriety. It was, necessary, however, to draw a distinction between a plinth and a pedestal. He believed that the ancient sculptors did not wish to design anything in the shape of a pedestal, which could in any way vie in interest with the figure itself. Mr. Cockerell had referred to bronze pedestals, and there could be no doubt that they were introduced with the view of giving greater effect by their burnished surface and fine edges. When he was in Vienna in January last, he observed an equestrian statue of the Archduke Charles, which in his opinion was one of the finest productions of modern art. He had also seen two statues at Berne, in Switzerland, where an Englishman was lately killed in a bear-pit; the one, equestrian, which struck him as very fine and well composed. The ancients made it an invariable rule to gild their bronze statues. He did not know of a single instance in which this had not been done. If they examined the collection of bronzes at the British Museum presented to the nation by Lord Palmerston's brother, it would be found that the whole of them had been gilt. The statues at Berne and that of the Archduke Charles at Vienna, to which he referred, were of a bright brassy colour, and the effect was admirable, and contrasted agreeably with the smoke-begrimed statues with which we were acquainted in London. He begged, in conclusion, to propose a vote of thanks to Mr. F. P. Cockerell for his extremely interesting and erudite communication.

Mr. Godwin, V.P., in seconding the motion, observed that Mr. Cockerell appeared to think it invidious to refer to contemporary art. No doubt it might be so: it was not pleasant either to say or hear hard words, but really it behoved some one to speak out, otherwise under present circumstances it would soon be impossible for an educated eye to walk through the streets of the metropolis without being pained. To use the mildest possible expression, much that had been done of late years in the way of public sculpture was unfortunate. Take, for instance, the Crimean monument in Pall Mall. It was designed by Mr. Bell, who was a sculptor whom they all respected for his abilities, and who was an artist to the backbone, working in all ways to advance his art. Nevertheless, it must be admitted that the aspect of the monument was not satisfactory. The great mass of granite which formed the pedestal was an eye-sore, and the effect of the upper figure seen from behind was anything but agreeable. The monument in question was an illustration of want of proper care in the selection of a position. Had it been placed like that to Molière, in Paris, for example, in an alcove, or against a building, and if the huge pile of granite had been cut up with bronze or other decoration, it might have been converted into an object worthy of the purpose intended and creditable to the artist. But at present it was neither the one nor the other. He felt persuaded that, if Mr. Bell had been allowed to carry out his own idea, and give expression to his own conception of propriety, there would have been no necessity to speak in

disparagement of the monument. Indeed, it was not impossible that some public comment on this monument might lead the Committee to take some steps with a view to its improvement. In the statue lately put up in Trafalgar Square, to the memory of Sir Henry Havelock, no care appeared to have been used in reference to the pedestal, and the result was a very unsatisfactory whole. The paper which they had heard that evening was most opportune; he trusted that the suggestions which Mr. Cockerell had thrown out would germinate in the proper quarter; and he hoped that, when a subscription was next made for a memorial of departed greatness, it would be not for a statue alone, but for "a statue and a pedestal," and that some artistic consideration would be given to the object as a whole.

Mr. HAYWARD said he thought it right, in justice to Mr. Bell, to remind the meeting that a letter had been published from that gentleman, in which he stated how unfortunate it was that the Crimean monument had been put up in its nakedness, as he had designed a good deal of ornament which had not been introduced. There was one class of pedestal which had not been referred to that evening, but to which he wished to allude, he meant that represented by the column of Trajan, a view of which was in the room. It had been constructed at a period when the arts were considered to be flourishing, and, as the idea had been copied in modern times, he would like to know from those calculated to pronounce an opinion whether a statue on a column was appropriate. For his own part he did not object to it, but he was unable to refer to any authority as to whether it was conformable with the canons of art or not. In his opinion the Nelson column in Trafalgar Square was an ornament, but he would like to hear some authoritative opinion on the subject, as writers on art were constantly sneering at a statue on a column. What he wanted to know was, whether it was or was not such an absurdity as some people imagined it to be.

Mr. F. P. COCKERELL said there were numbers of instances in Greek vases of statues on columns, but that they were very small statues and very small columns.

Mr. J. W. PAPWORTH, Fellow, accepted the challenge of Mr. Hayward, and would attempt to defend an objection to the practice of placing statues on high columns; that objection was independent of the question whether the representations noticed by the lecturer were conventionally lessened: it involved the discussion of the whole question of architectural support to sculpture. As a pedestal was only necessary to raise the sculpture so much above the circulating crowd that the sculpture should generally be fully visible, Mr. Papworth held that the larger the area the less would be the height necessary, after clearing the datum, which must be obtained by observation of the locality; that the *pot de feu*, serving as a termination to the monument at London Bridge, must be approved, as being an appropriate idea rendered in a manner which made that termination intelligible at a distance which would make any statue indistinguishable; that the practice of putting busts on pedestals formed of truncated columns is as satisfactory as that of placing life-size statues on the much lower pedestals which are usual in galleries; and that a pedestal does not require a cap-moulding, so long as the pedestal is plain. About five years had passed since Mr. Hawkins, of the British Museum, had been good enough to examine for him the busts, about thirty in number, in that collection, and it was found that five or six of them stood upon the well-known moulded base formed out of the same block as the bust, and Mr. Papworth received this information as sufficient to subvert the opinion expressed by Quatremère de Quincy that in ancient times the busts had no such "piédouche." After making a series of sketches, illustrating the nature of the difference in shape and size of brackets and pedestals which Mr. Papworth considered suitable for busts, statues of life, heroic, and colossal dimensions, groups and equestrian statues, calling attention to the necessity of designing such pedestals with reference to their perspective and geometrical effect, as balancing the outlines and masses of the works which they had to carry, he supported the argument that gilt statues were enormities, and that gilt

bronze statues were indefensible, and that large works in bronze were mistakes, by recapitulating the canons of taste, upon the subject of size as taken in connection with material, which he had endeavoured to establish when his review of the Exposition de l'Industrie Universelle, 1855, was offered to the Institute.

Mr. C. H. Smith, Hon. Member, observed that there was one pedestal and statue which had not been referred to in the discussion, and which on that account he ventured to allude to, namely, the statue of William IV., at the junction of King William and Gracechurch Streets, in front of London Bridge. This statue was remarkable in this respect, that it was the only one in London in which the pedestal and the statue were of granite. He deprecated the use of bronze in public monuments, because in troublesome times it became the object of destruction for its intrinsic value. Depend upon it there would be no Elgin marbles in the British Museum if they had been made of bronze. In his opinion no public statue or monument ought to be made of any substance which was of use, except for that particular object. No one, for instance, would ever dream of knocking down the statue and pedestal of William IV. for the purpose of macadamizing London Bridge. The statue was designed by Mr. Kelsey, who was a competent artist, and whose knowledge of the human figure was especially good. He believed the temptation to make away with bronze accounted for the destruction of many ancient statues, and that the statue of the Colossus at Rhodes would in all probability have remained until this day were it not that it was made of bronze. Look, for instance, at the desecration of bronzes in our village churches and cathedrals. Why, the only way to preserve them, would be to put silver alongside of them, and renew the silver whenever it was stolen.

Mr. Horace Jones, Fellow, said it occurred to him that the use of a high column for a statue was occasionally desirable, as it put the statue out of sight. With respect to gilt statues there was that of Milton at Hull, which was beautifully gilt, and looked like a brazen calf! He fancied that the statues referred to in Venice (and which could not have been raised higher up in order to keep them out of the way of the cabs and omnibuses) were put on lofty pedestals in order that the persons in whose honour they were raised, might be supposed to overlook the great Republic with whose fame their deeds were associated.

The President in putting the vote of thanks to Mr. F. P. Cockerell, expressed his satisfaction that the paper read by that gentleman had given rise to an interesting, practical, and he hoped what would prove a suggestive consideration of the subject. It was quite clear that reform in the matter of public statues was required. The schools of the Continent of Europe had greatly cultivated this department of fine art during the actual century, and they were happily open to our observation and study. He had no doubts of the reception of these discussions by our brothers of the art of sculpture. Our own art, like theirs, was open to fair criticism; he, indeed, felt obliged by the observations of the learned professors of the sister arts, whose productions were essentially affected by so interesting and conspicuous an art as that of sculpture. He hoped that nothing disrespectful had escaped the members of the present meeting; for it was clear that no art could be regarded as more nearly related or higher in the esteem of architecture than the art of sculpture.

ON THE OPERATIONS LATELY CARRIED ON AT BAYEUX AND CHICHESTER CATHEDRALS.

By George R. Burnell, C.E.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, May 27, 1861.

The preservation of the monuments connected with our civil or our religious history is a subject of so much importance, and it is one which appeals so strongly to the feelings of all who are connected in any manner with the architectural profession, that it would be useless here to enter into any explanation of the reasons for my venturing again to call your attention to the contemporary events I seek to place in parallel. A great national calamity has befallen us in the utter demolition of the beautiful spire of Chichester cathedral: it seems to be apprehended by persons able to form correct opinions in such cases that the spire of Salisbury cathedral is in a state nearly as dangerous as that of Chichester was about twelve months since, and some others of our most beautiful Mediæval buildings are unquestionably in a very unsatisfactory condition. Under these circumstances it seemed, to me at least, very desirable that an attempt should be made to derive all the practical information it was possible to do from the lessons furnished: on the one hand, by the sad accident which has attended the works at Chichester; on the other, by the successful operations of the same nature executed at Bayeux. Possibly, in this manner, we may learn the nature of the danger now threatening Salisbury, and the best means of obviating it; at any rate, it is our duty to compare the technical processes adopted in the respective cases referred to, which have led to such markedly different results.

In the case of the Chichester Cathedral it would appear that the objects which the original promoters of the restoration proposed to themselves, and which served as the basis of the instructions given to the architect, were "to remove the existing choir fittings and to open out the choir, in order to afford greater accommodation for the public at the cathedral services;" and it was distinctly understood, as I have been informed, that "*the works so contemplated were not to include any structural repairs.*" The article in the "Builder" of March 2nd, 1861, from which the quoted words not in italics have been extracted, proceeds to observe that "the ancient stalls and the Arundel screen concealed, to a considerable height, the surfaces of the piers under the great arches of the steeple." The piers rose to a height of about 45 feet, from the floor to the springing of the semicircular arches, the openings of the latter being respectively 25 feet 8½ inches and 24 feet 2 inches in the portion of the arches which was able to produce any dynamical action. Above the semicircular arches there were some pointed discharging arches of great strength, if we may judge by the published description of them, but as the weight supported by the two series of arches was eventually brought upon the piers at the intersection of the nave and of the transept, their stability, and that of the superincumbent tower and steeple, was in fact made to depend upon the resistance of those piers to the various efforts exercised upon them. "The height of the extreme portion of the steeple was about 272 feet from the ground; the weight of the superstructure" (from the line of the capitals—I still quote the "Builder"), was about 5,664 tons; the bearing surface of each pier is stated to have been 83 feet" (or 11,952 superficial inches), though from some dimensions I obtained in the cathedral itself I suspect that the available bearing surface was not much more than 74 feet (or 10,656 superficial inches), or, in round numbers, the crushing weight at the springing line might have varied between nearly 264 and 300 lbs. per superficial inch, acting upon an irregular rectangular pillar, whose height did not exceed nine times the dimension of the smaller side;

and it is to be observed that the longer axis of the piers corresponded with the centre line of the wider openings, and to some extent with the line of the action of the prevailing wind, thus offering the greatest resistance in the direction of the greatest external action to produce overthrow.

The piers of the tower (as hereafter I propose to call the piers at the intersection of the nave and transept, immediately under the tower and spire) were portions of the early part of the cathedral; and they were constructed, as we can now too plainly perceive, in the very worst possible manner. They were formed of a species of ashlar casing, composed mainly of a tertiary shell limestone from the Isle of Wight, with, from here to there, stones obtained from other quarries; and the interior was filled in with concrete, apparently made of chalk-lime mortar, and broken stones and flint. Now, the Isle of Wight stone itself is said only to be able to support a crushing weight of from 466 to 566 lbs. per superficial inch, when used in the direction of the bed; although I am myself far from admitting the correctness of the experiments on which this statement was made. Yet as the sectional area of the ashlar coating was not more than one quarter of the whole area of the piers, and the mortar of the interior was so badly made as to offer hardly any resistance, nay, rather to act in such wise as to tend to burst the outer casing, and at any rate to fatigue rather than to assist the ashlar; the wonder really is that the piers should have supported for so many years, as they actually have done, the weight thrown upon them. It is evident, indeed, even now, that some very serious settlements must have taken place in these piers, and in the arches over them, at a very early period in the history of Chichester Cathedral; for, on the eastern wall of the transept, it is easy to discover that when the south-eastern part of the transept was built, the horizontal courses over the arches of the aisles had been deranged by the subsidence of the great piers, and that they had sunk to such an extent in the immediate neighbourhood of the piers, as to require the introduction of a feather-edged course to bring the masonry to a level line. Some distinctly marked ancient movements may likewise be traced to have existed in the various arches still standing in this part of the cathedral, all of which are of a remote date; but little attention seems latterly to have been paid to them, because they had not increased of late years, and because the parts of the piers which displayed the effect produced upon them were hidden by the woodwork of the stalls, and by the Arundel shrine. On the recent demolition of the last-named accessory details (the stalls and shrine) the defects of the two supports were laid bare. Large fissures were found to exist in the piers, and in the south-west one it was found that a large portion of the ashlar casing had actually been cut away to receive the Arundel shrine: the nave arches had likewise been distinctly fractured in consequence of the subsidence of the piers. From all that I could observe I feel convinced that this subsidence had arisen from the compression of the masonry of the piers themselves, and not from any compression of the foundations. A state of equilibrium had, however, been attained; and though it might at any moment have been disturbed, had any new forces been brought to bear on the building, yet that equilibrium might in all probability have lasted for centuries if the works for the removal of the screen and stalls had not been undertaken. The vibration of the steeple has been dwelt upon as a cause of the failure of the tower piers to a much greater extent than I think was justified. It is more than probable that at the precise moment of rupture the effect of the wind may have caused a movement which precipitated the fall; but the steeple had for centuries been exposed to and had resisted the effects of gales more severe than the one which is considered to have produced the catastrophe we so much deplore; and even in the early spring of last year (1860) the steeple had been exposed to a gale exercising a horizontal effect more than double that of the gale of 21st February last. The immediate cause of the fall of Chichester spire must then, I think, be sought for in the operations lately carried on for the repair of the tower piers.

The various instances quoted by Professor Willis of the fall of other steeples, and the accidents

which have lately occurred to some of the great engineering works of the age, might have induced the parties intrusted with the maintenance of Chichester Cathedral to suspect that there was danger in disturbing any portion of structures so badly built, as nearly all Mediæval buildings notoriously are. I cannot, therefore, for my own part refrain from expressing my regret that the Committee of 1859 should have adopted as their ruling principle "that accomodation in the cathedral was alone to be attended to, and that no structural works were to be undertaken." The limited instructions given to the architect under this arrangement compelled him to seek for temporary palliations for any evils he might discover in the course of removing the old works; and were, in fact, his justification for attempting to recase the fissured piers, rather than at once undertaking their reconstruction. Still, when a building has stood apparently unmoved for centuries, it is difficult to believe that a few slight jars, or the removal of some accessory fittings which seem to have only a slight connection with the substantial parts of the structure, would be able to destroy that which had lasted so long; and architects and engineers of the present day who are accustomed to build so strongly as to defy even exaggerated efforts, are too often unaware of the risks they run in dealing with the works of the Mediæval architects, who were as a general rule very ignorant of the scientific part of their profession, so far as the use of building materials was concerned. The fatal, though easily justifiable oversight made at Chichester, seems to have consisted in the belief that the interior of the piers of the tower was able to support any notable portion of the superincumbent weight whilst the exterior coating was being repaired. From the state of the ruins and the nature of the phenomena which attended the fall of the steeple, it seems to me evident, as I said before, that the concrete filling of the piers had been originally executed with chalk-lime mortar, badly prepared, and placed in contact with materials which were able to abstract from it the water necessary for the crystallization of its hydrate of lime. It is said that shortly before the fall of the spire, dry mortar dust, as workmen would say, poured occasionally from the fissures; thus proving that the hearting of the piers only consisted, in fact, of an incoherent mass of dry rubbish, able to flow over itself in the manner of dry sand. It would have been possible to have ascertained whether or not this had actually been the case, before the repairs had gone to any great extent, simply by boring into the columns in several places in their heights; and some additional strength might have been given to the hearting by injecting liquid cement mortar through the bore-holes themselves, if the interior had been found to be tolerably sound. As it happens, any such measure would have been utterly useless; and, speaking as I now do from the vantage ground of *ex post facto* knowledge, it is evident to me that the proper course to have been taken directly it was discovered that "the tower piers were worse than had at first appeared," was at once to have removed them, and to have rebuilt them in sound ashlar work. *A fortiori* was it necessary to have needled and centred the tower, and the adjacent arches, when the fresh movements declared themselves in November last? If vigorous measures had then been adopted, it would have been possible to have saved the steeple; in January, when "it was determined to add centres in all the arches," there was still time enough to have prevented the fall; in February it was too late to do any good, and the building must have been condemned, even had no gale occurred on the 21st of February.

The story of the repairs of Bayeux Cathedral is strikingly like this story of Chichester, though the measures adopted and the results obtained were so different in the two cases. Settlements had taken place in the masonry of the tower piers of Bayeux some centuries ago; recent repairs and alterations in the fittings had laid bare the marks of these movements, and had disturbed the conditions of equilibrium into which the materials of the piers had subsided, so that at Bayeux, as at Chichester, the old movements were resumed; the materials forming the piers themselves began to yield unequally in the section of the piers; but at Bayeux the hearting was sounder than the external casing, and it

was the latter therefore which gave the first symptoms of immediate danger. The architects consulted in this case seem at once to have perceived the magnitude of the threatened evil, and there was a unanimous conviction amongst them, that the only course to be adopted was at once to rebuild the piers. Differences of opinion, however, arose as to the manner of effecting this object. The diocesan architect and M. Viollet le Duc thought that the simplest and cheapest plan was to pull down and rebuild the tower from its very foundations; others thought the original structure might be saved by judiciously executed underpinning; and M. Flachat—whom some people would call merely a railway engineer—had sufficient influence to persuade the public authorities to adopt that opinion. M. Flachat then was employed to execute the work of reconsolidation, and he succeeded in effecting it in the manner and under the circumstances recorded in the very remarkable book lately published by his assistants, MM. Dion and Lasvignes. Bayeux Cathedral still stands, with the original work of its square tower and octagon lanthorn intact; and according to all probability, it will continue to do so for centuries to come. So efficiently have the recent repairs been executed, in fact, that if this glorious structure should again be menaced with ruin we may confidently predict that the tower will be exempt from the danger, and that its substructure will bid defiance to the ravages of time, so long at least as the stone used for the pillars is protected from the action of frost. I introduce the latter observation designedly, and shall have occasion hereafter to recur to it.

M. Flachat, in this case, commenced his operations (which, perhaps, I ought to say were only commenced after some injudicious works had been attempted by the local architect of the cathedral) by forming an artificial and incompressible foundation of concrete, upon which subsequently he erected his centres and needles. The concrete itself was supported upon twenty tubes (of wrought iron, and of 4 feet internal diameter), subsequently filled with concrete, and sunk through the earth in such a manner as not to produce any vibration under the pillars; and round these tubes a general platform of concrete, rather more than 9 feet in total thickness, was inserted between the foundations of the piers. The tubes rose about 3 feet into the concrete, and were carried down into one of the stiff blue clays of the lower oolitic formations, into which they penetrated about 2 feet. Upon the concrete bed M. Flachat then erected a double set of frames of whole timbers on either side of the centres originally placed to support the arch, for the purpose of forming the seating of a set of needles carried upon a series of screw-jacks, and made to support the masonry of the square part of the tower, a little above the vaulting of the nave and transept. The tower was carefully hooped with iron bars, keyed up whilst they were still hot, so that their shrinkage actually closed the masonry which had previously been fissured over the openings; and before altering the centres to the form M. Flachat thought requisite, he also surrounded the springings of the arches of the nave with a strong wrought-iron cradle, intended to resist the lateral thrust. The centres were then strengthened and modified, so as to allow the easy underpinning of the piers; and the lateral arches of the nave, choir, and transepts, which had participated in the movements of the piers of the tower were carefully shored up. Every precaution was taken to protect the original mouldings of the vaulting, and the sculpture of the capitals, columns, and bases by inclosing them with rubble masonry, against which the shores were made to act directly. It is to be observed that the needling was totally independent of the centres of the great arches, and was designed solely to support the weight of the tower and octagon above the line of the vaulting; the arches and the spandril fillings were all that bore directly upon the centres themselves.

I must refer you to the book before-mentioned for the detailed accounts of the centres, of the calculations on which they were designed, and of the precautions observed in placing them, in making good the old and the new work, and, finally, in the delicate operation of removing the scaffolding, centres, and needles. I do this with the more earnestness because I am convinced that the architectural

student who might study the various questions incidentally raised with respect to the dynamical efforts exercised, to the strength of the various materials employed, and to the mechanical powers brought to bear upon the work, would rise from such study with a truer view of the importance of the scientific part of his professional education than would appear to prevail at the present day. In fact, and at the risk of raising an issue somewhat irrelevant to the subject before us, I hold that a properly qualified architect ought to be a scientific engineer, and that a good engineer ought to be equally an educated architect, or, in other words, that the modern distinction between the two branches of our profession is a very unnecessary one. In works such as the repairs of the piers of the towers of Chichester or of Bayeux Cathedrals, the scientific part of the architect's duties prevails in importance over the artistic part, and I know no better authority upon the subject than the book in question. In our own language I am not aware that any work can be cited in which the operations for the underpinning of a lofty tower have been so elaborately described as they have been by MM. Dion and Lasvignes, who have, moreover, had the advantage of practically superintending the works they have so well described.

One very important remark remains to be made upon the general subject of the repairs of buildings, so seriously affected as were both Bayeux and Chichester Cathedrals. It is this, viz., that the cost of the works executed by M. Flachat, for the maintenance of the tower and octagonal lanthorn of Bayeux was not less than £32,220., and that M. Viollet le Duc had estimated that the demolition and the reconstruction of the same works could have been effected for a considerably smaller sum. I am somewhat sceptical, I must confess, as to the correctness of M. Viollet le Duc's estimate in this latter case, and the amount of Mr. Scott's estimate for the repairs of Chichester Cathedral confirms me in this opinion, even after making all possible allowances for the prices of labour and materials in the two countries, for the local conditions, and the peculiar characteristics of the two buildings. Be this as it may, it is proved that the cost of underpinning a structure of about 6,000 tons weight (in round numbers the weight of the upper part of Chichester tower and steeple was 5,664 tons, that of the tower at Bayeux was 3,700 tons), at a height of about 50 feet from the ground, must have greatly exceeded £32,000. Candidly, I do not believe that previously to the execution of the works at Bayeux, or to the fall of Chichester Tower, any architect who had been bold and honest enough to have said that such a work was necessary would have even been listened to. Still more firmly am I convinced that no committee whatever would, in our commercial country, and in our industrial age, have succeeded in raising the funds for carrying such a work into effect. The Committee for the repairs of Chichester Cathedral were then, I think most sincerely, perfectly justified in confining their attention to the improvement and alteration of the internal fittings, and, for the time, in avoiding to entertain the consideration of structural defects. The manner in which the partial repairs actually attempted were executed was, unfortunately, one which revived the injurious actions previously observable in the building, and which had remained, as it were, quiescent for so many years. But the limits of resistance of the piers must have been so nearly attained when the slight jars produced during their recasing, and the trifling alterations in the conditions of equilibrium produced by the removal of the stalls and of the Arundel screen, could determine the crushing of those piers, that a cup so full might at any time have run over; or, in plainer words, any gale of wind able to produce a long series of isochronous vibrations in the steeple might have produced the same effect, and caused the piers to crush under the action. I am firmly persuaded also that no architect or engineer, but one who had been practically acquainted with the wretched style of building adopted by the Mediæval builders, and who had witnessed the failure of modern lofty structures, could have suspected, before the fall of Chichester spire, the truly awful state of the masonry of the piers on which it rested. There was hardly enough energy displayed in the attempts made to arrest the fall when the imminence of the danger made itself felt; but, apart from the regret

all true lovers of archæology must feel at the loss of the original monument, and at the substitution in its stead of a modern copy, it is, to my mind, questionable whether, in the end, the pecuniary cost of re-building the steeple, as must now forcedly be done, would much exceed the cost of underpinning and replacing the original piers and arches. Without being optimists, or holding the extreme doctrine that "whatever is, is right," it should be to us a source of comfort to know that the actual amount of injury produced to one of the most beautiful monuments of the ecclesiastical history of our country has not been greater than the destruction of the steeple and the adjoining bays of the nave, choir, and aisles, and that, in common prudence, the parties intrusted with the care and preservation of the building could hardly have adopted a different course from the one they have actually followed. That so serious an accident as the fall of this spire should have occurred, without injury to life or limb, is, I would add, highly creditable to the clerk of the works and to the builder employed; indeed, both Mr. Thompson and Mr. Bushby conducted themselves admirably under these very trying circumstances.

Before closing these remarks, I would beg to be allowed to call your attention to one or two practical questions connected with the nature of the materials employed at Chichester and at Bayeux. On the occasion of the discussion on the paper read by Professor Willis in these rooms, Mr. A. Thompson dwelt upon the small powers of resistance of the tertiary shell limestone, from the Isle of Wight, which had been used in the construction of the piers. He stated that, when loaded transversely to its bed, this material only resisted a load of about 446 lbs. per superficial inch; but when loaded in a direction parallel to the bed, it was capable of supporting a load of 860 to 1,070 lbs. per superficial inch. Mr. Thompson also calculated that the actual load on the superficial inch on the cross section of the piers was not less than 331 lbs., or rather more than my own rough calculation had indicated. Mr. Thompson did not state whether the breaking weights he quoted were the instantaneous, or the ultimate, breaking weights of the stone; and I mention this omission, because it is one which materially affects the value of the information given. Vicat has shown that stones will frequently yield, after three months, under loads which do not exceed one-third of the breaking weight applied instantaneously; and as irregularities in the texture of stones are very common, it is fair to assume that the safety load they ought to be made to bear should never approach even the lower limit. Mr. Thompson stated that the stone had been used bedwise, and therefore in its weakest direction. If so, I cannot but suspect that some error has crept into his observations; for I am sure that a stone which would crush under a load of 446 lbs. would not support for centuries a load of 331 lbs. As to the hearting of the pier, if it had been executed in good chalk lime brickwork, it might have carried a load of about 500 lbs. on the square inch, had every imaginable precaution been taken in its execution; executed as it was in bad rubble, or rather in bad concrete, it could not have supported even its own share of the work, or a load of 331 lbs. Under these circumstances the outer casing must have borne a load far in excess even of the 331 lbs. calculated by Mr. Thompson; and they go far to convince me that the safety limits of the shell limestones must be higher than Mr. Thompson's experiments would appear at present to indicate.

Unfortunately we do not possess any tables of the resistance of English building stones to crushing weights, which can be considered to be perfectly satisfactory. All the experiments recorded, excepting the few mentioned in Mr. E. Clark's account of the Menai Tubular Bridge, have been made upon small cubes of at most 3 inches on the side. In practice, however, the resistances are singularly modified by the joints, and the interposition of mortar between the bearing surfaces; whilst Vicat's experiments upon small superposed cubes seem to indicate that the number of such horizontal joints considerably modifies the resistance of each of the cubes. Again, the results usually quoted, of late years, of the resistances of building materials have been obtained by the use of the hydraulic press, an instrument

which is very likely to get out of order, and whose indications cannot easily be watched with the accuracy required in investigations of this delicate nature. Mr. Hodgkinson, in his experiments on iron, wood, and some kinds of stone; and M. Flachat, in his observations upon the resistances of the Aubigny, Orival, Caen, and Ranville oolites, used a system of levers in the applications of the weights to those materials; and though unquestionably there is a probability of the weights being, in such cases, made to bear unequally upon the exposed surfaces, the danger is not greater than when the hydraulic press is used; whilst, on the other hand, it is far easier to apply the load by slight increments, and to watch its action during even a lengthened period. After all, the most valuable observations upon the resistances of building materials are those to be obtained from observation of the conditions of success and failure of actual constructions, such as Rondelet records in his "*Traité de l'Art de Bâtir.*"

I said that I would refer to the selection, by M. Flachat, of the Aubigny stone for the ashlar of his new piers; and I do so because I observe that the Aubigny stone is being employed rather extensively in London, and because I am convinced that its use would be attended with danger. M. Flachat chose this stone because it yielded more satisfactory results under the trials he exposed the various local stones to, so far as their resistances to crushing weights were concerned; but MM. Dion and Lasvignes expressly state that the Aubigny stone yielded easily under the action of frost, if used exteriorly. Any one who may have examined the Mediæval buildings in the town of Falaise must also be convinced that the opinion last quoted is lamentably correct; for the Aubigny stone used there has decayed in a frightful manner. I am, however, for my own part, disposed to believe that even when used in the exterior of a building the Aubigny stone is exposed "to take on" a decay somewhat analogous to the mysterious decay which we know affects the Purbeck or the Petworth marbles in our own cathedrals; and though the sectional area of the piers at Bayeux is so great as to remove any fear of the decay of the outer surface affecting the stability of the structure, yet I fear that the edges of the various courses will ultimately crumble away like those of the Purbeck marble, and produce an unpleasant series of horizontal lines upon the piers. It may be centuries before this effect is produced; but I confess that, knowing what I do know of the Aubigny stone, I regret to see it used in a building destined, I hope, to exist "not for an age, but for all time."

Finally, some importance seems to have been attached by the persons who were charged with the superintendence of the recent operations for the repair of Chichester Cathedral, to the use of blue lias lime in conjunction with the stone casing applied to the piers. In this case, I think that the use of that cementing material was a mistake,—of a minor character, it is true, because whatever lime or cement had been used was a matter of absolute indifference, and would in no wise have prevented the fall of the steeple. In all future operations of the same kind, however, to be executed elsewhere, it seems to me that we may learn a useful lesson from what thus occurred at Chichester. Evidently the rapidity of setting, and the hardness of the set mortar, are the most essential conditions to be required of those materials in works of restoration; and, therefore, I hold that the new casing ought to have been set in Portland cement, rather than in blue lias lime mortar. M. Flachat used large quantities of Portland cement in setting the large ashlar blocks he used in the piers of Bayeux; *â fortiori*, a cement of equal energy, should have been used in setting the thin casing applied at Chichester. In addition to this consideration, there is another practical objection to the use of blue lias lime in the south-east of England, in the fact that there are so few masons, or even bricklayers, who know how to use it; and I am strongly of opinion, from what I actually witnessed in the ruins of Chichester Cathedral, that the blue lias lime there employed had never been properly slacked: its hydration was deficient in many samples.

The fall of Chichester Cathedral, and the danger said to menace the glorious spire of Salisbury, raise one singular subject of discussion which may fairly be submitted to this Institute, which boasts for one of its objects the advancement of the true interests of architectural education, and, I hold by implication, of the preservation of the best models of architecture. It is this, viz.,—whether it be not desirable that some organisation, analogous to the one which prevails amongst our neighbours, for the preservation of the monuments connected with the history of the country, should be introduced in England. The central Government of France contributed not less than £28,000., out of the £33,000. nearly, spent at Bayeux. The repairs of Notre Dame at Paris will eventually cost the State no less than £360,000.; and, as the ancient buildings of a country are, in fact, a portion of the intellectual property of the whole nation alike, it does seem to me that their maintenance should not be left to local or casual efforts. No doubt the absorption of the ecclesiastical and capitular revenues of the French churches by the Governments subsequent to 1789, has placed the ecclesiastical affairs of that country on a different footing to those of England. Nevertheless, I cannot conclude without expressing the regret that the attempts now being made to complete the restoration of a monument so closely connected with English history as Chichester Cathedral should depend for their success on the results of a public subscription. At present it would, of course, be in vain to expect any assistance from the State, and our efforts must be confined to assisting the subscription list. This may be done with the more confidence that Mr. G. Gilbert Scott has been entrusted with the execution of the future works—a fact which ensures that everything which science, skill, and taste can bring to bear upon them will be applied.

Mr. Blake, Fellow, said, with reference to their friend Mr. Burnell's able paper, there was one thing that seemed to have escaped his observation, and that was that, some fifteen or twenty years ago, an earthquake was most perceptibly felt at Chichester. Having been, for many years, resident at Chichester, he could remember the last shock, and he believed the cathedral had been affected by three or four shocks of a similar character. And though the imperfect Mediæval construction might have had something to do with the fall of the spire, yet he could not help thinking that those shocks might have injured the piers which supported such a ponderous weight. Surely the building must have felt the vibration of such a powerful shock as that of an earthquake.

Mr. G. Gilbert Scott, R.A., Fellow, said that in offering some observations upon the paper just read, it was not his intention to go into the history or causes of the failure of the piers, and the final catastrophe which had befallen the tower of Chichester Cathedral. His connection with that cathedral had no reference to any questions as to what had occurred, but simply to the rebuilding. Mr. Slater was the architect to the Dean and Chapter; but as the public had come forward to aid that body, and had, in fact, undertaken the rebuilding of the tower, they had requested him (Mr. Scott) to act as their professional representative, Mr. Slater continuing, as before, architect to the Dean and Chapter; so that they were acting conjointly in the rebuilding of the tower. He thought it necessary to mention these particulars, as whatever had come to his knowledge as to previous occurrences had only been picked up accidentally. Our country being studded with beautiful specimens of Mediæval architecture, it becomes in the highest degree important that, as architects to whose hands the care of such buildings may be entrusted, we should consider well what means should be adopted for their security when found to be in danger of failure; and here he was bound to say that Mr. Slater had been peculiarly unfortunate in the circumstances under which the recent works at Chichester had been placed in his hands. Had he been called upon by the Dean and Chapter to report to them upon the condition of the tower, and the means required to ensure its safety, the case would have been quite different; as, under such circumstances,

his attention would have been especially directed to one point, and it is probable that the real state of the case would then have received timely investigation, and funds would have been procured and means adopted which would have averted the impending calamity. He had, however, received no such instructions. He was in the position of a doctor called upon to prescribe for a cutaneous disease, while a disease in the heart existed, though unknown. It may be that under such circumstances the latent disease may be detected by the quick-sighted physician, from the expression of the countenance or other accidental indications, but he could hardly be blamed for failing to discover a malady to which his attention had not been directed. Mr. Slater was, in fact, employed more especially by a committee formed to carry out a work as a memorial to the late Dean Chandler, and that work was the re-arrangement of the choir, with the opening out of the nave for the accommodation of an increased number of worshippers; and he was, as Mr. Scott believed, expressly directed NOT to turn his attention to constructive questions, as there were no funds for them. The state of the tower was at that time unsuspected, and only came incidentally and bit by bit under notice while the operations were going on. It might be that an architect under such circumstances might discover the extent and serious nature of the mischief though his attention had not been specially called to it; but when his instructions were merely to re-arrange the seats of the choir, he could hardly be considered bound by his professional responsibility to go fully into the question of the safety of the tower. This was a matter which ought not to be lost sight of in considering the nature and degree of responsibility attaching to the architect of Chichester Cathedral. It was, however, discovered, through the removal of the old fittings, that very serious mutilations had been inflicted upon the lower part of the piers which supported the tower, and means were taken to repair them. In drawing a comparison between the circumstances relating to the repairs of this tower and of that of Bayeux, he thought it would be unfair to indulge, as Mr. Burnell had done, in invidious contrasts between railway engineers and architects, and between the success of the one and the failure of the other; for in point of fact, a railway engineer *was* called in at Chichester as soon as the state of the tower piers was discovered, and the works since carried on by Mr. Slater had been executed under his advice. This engineer made three regular reports, and a fourth supplemental one, all of which he (Mr. Scott) had seen, and there was nothing in any of them to tend to any different or more decided course than that which had been adopted by Mr. Slater. The last report, indeed, had been made after the latter gentleman had operated on the north-west pier, and it stated that the works had been carried out in a masterly manner. While, however, we ought to be tender and generous towards those members of our profession who were unfortunate enough to be called upon to deal with such difficult and delicate works, we ought not, on the other hand, to allow such feelings to cause us to shut our eyes to the consideration of the proper means to be adopted to avoid the recurrence of such calamaties. On the contrary, the occurrence of such a catastrophe should lead us to consider the more carefully by what measures it could have been prevented had full information of the evils which existed been possessed when the works were undertaken. It happened very unluckily for his (Mr. Scott's) comfort and peace of mind, that he had had a good deal to do with buildings in the condition in which Chichester Cathedral had been found to be; he wished never to have to do with such works, as they are great disturbers of one's peace and happiness for the time. At an early period in his practice (in 1841) he had been called in to inspect the Church of St. Mary, at Stafford. He found that all the piers of the tower were crushing, and that, although attempts had been made from time to time to arrest the failure, these reparations had themselves in the course of time given way. He made specifications for the shoring up and partial rebuilding of the piers, and, to show the uncertainty of such works, he would mention that the two competing builders, both men of long practical experience, estimated the work, one at £500., the other at £1500. It was carried into execution by the former as day work, and came

to £2000! The course taken at Stafford was that which has generally been adopted, excepting at Bayeux. What they did was, not to rebuild the entire mass of the pier, but to go gradually round it, replacing the whole of the external stone and as much of the internal core as was crushed or disjointed, till, by the time they had completed the pier, it was virtually almost entirely new. The restoration at Bayeux, on the contrary, was a case of entire rebuilding, the old piers being entirely taken down and rebuilt from their foundations. At Stafford, the first operation was to bind the tower round (internally) with very strong iron bars, with right and left screws, which were screwed up as tight as possible. This was done at two different levels. They then dug round the base of the tower as low, at the least, as the bottom of the foundations, removed the remains from all surrounding graves (which had, as is so often the case, done very great mischief, being much deeper than the foundations), and filled up the whole space with a solid mass of concrete. Having shored the arches and the piers, so as to carry as much as possible of the superincumbent weight, they began gradually to remove the loose stonework and to put in new (or rather *additional*) foundations, spreading out upon the new concrete. This operation requires a system of moveable shoring quite distinct from the more permanent shoring already mentioned. This secondary shoring is continually being moved upwards as the work proceeds, no part of the old work being taken out at one time beyond what is necessary to give room for the insertion of the new portions actually in hand at the time. In each course, or at short intervals in the height, they inserted chain bars (which are best of copper), in short lengths, but so constructed as eventually to form continuous ties all round the pier. In effecting these operations he was brought to the conclusion that it is impossible to exaggerate the danger and the difficulty that exists in providing shoring of sufficient strength; for in this, as in every work of the kind in which he had been engaged, he found that all the shoring he could by any possibility get in was only barely sufficient for the purpose. He had seen enormous timbers bend under the pressure to which they had been subjected; and he wished to offer his most decided opinion that in such cases it was absolutely necessary, before a single stone was removed, to insert all the shoring which could be brought to bear within the space to be operated upon. He would also advise that in no case should the shores be of *half* timbers, or of timbers of an *oblong* section, but that they should be of square or round timbers, so as to have no tendency to bend in one direction more than in another (in large works, indeed, the shores must be larger than single timbers). In one case (a minor work) which he had had in hand, he had expressly provided for the use of whole timbers in the specification, but the clerk of the works had permitted half timbers to be used, and the consequence was that the shoring gave way very perceptibly, much to the detriment of the work. Another precaution he would recommend was the use of the hardest stone which can be procured; for if this be neglected the new work is almost sure, when the shoring is removed and the weight brought to bear upon it, to split; and it is needless to say that cracks in such supplemented masonry are far more dangerous than in a new structure: for by throwing the weight upon the old core (if any remains), or upon piers not yet repaired, or upon other old work, such partial failure of the new stonework may lead to the most serious consequences. Under no circumstances, therefore, should anything approaching a soft stone be made use of, whatever may be the materials of the old pier. The next thing he would urge is the avoiding of ordinary *lime* mortar and the use of *cement*. Besides setting the new work and pinning it in cement, it had been his practice to run the core behind with liquid cement, first pouring in water and then the cement grout, which, when thus used, he had found in some cases to penetrate the interstices to a depth of nine or ten feet below the level at which it was poured in, as if it were so much quicksilver. The next work of this kind in which he was engaged was St. Mary's, at Nottingham, where the piers were smaller and more lofty, but the weight greater, and the operation more difficult, owing to the smallness of the piers. The very able clerk of the works who conducted this work had left in his hands

a complete and very interesting description of the entire operation, which he had wished to bring to the meeting, but could not lay his hand on it. At Aylesbury, where he had carried out a similar work, he had been obliged to re-construct the foundations, and there, as elsewhere, he found that the shoring, though more perfect and systematic than in any of the former works, showed itself only just sufficient for its purpose. This was in some degree satisfactory, as it prevented the employer from saying afterwards that too much money had been thrown away on timber-work. He remembered that, while engaged at Stafford, on one occasion a loud report was heard by the workmen, like the report of a gun; and it was found that one of the pillars of the chancel (quite unconnected with the tower) had split almost from bottom to top, owing to some indirect pressure brought upon it by the operations going on at the tower; which shows that the shoring should not be limited to the tower itself, but should in some degree be extended to adjoining parts. At Nottingham they wanted for some purpose a longer and larger shore than usual, and they procured from Hull a baulk of yellow pine of great length and about 2 ft. 6 span, one of the largest Mr. S. had ever seen, and yet it bent under the enormous pressure brought upon it, and had to be stayed and braced to keep it straight. On the subject of shoring he would offer two more observations: the first was, that it is a mistake in such cases to make use of ordinary centering under the arches. Centering pre-supposes the sufficiency of the piers and has only to carry a portion of the weight of the arch-stones while the arch is incomplete; shoring, however, under a failing tower is intended to relieve the piers of a weight they are insufficient to sustain, and must be capable not only of carrying the stones of the arch but the load sustained by them; besides this, the portion of the centre and its supports which is near to the pier would be in the way of the shoring required by the pier itself. The shoring of the arch must, however, depend, as to its construction, on the question, whether the load is on the apex, or the arch, or on its haunches. The second point is, that the shoring should have in all cases a special foundation provided for it. The floor of the church is wholly insufficient for this purpose, and it would be a fatal error to trust to it. The works, however, which he (Mr. Scott) had carried out were all of small scale as compared with the towers of cathedrals, as those of Chichester and Bayeux. The great typical example of such works in England was the reparation of the tower of Hereford Cathedral by the late Mr. Cottingham. He had endeavoured to obtain particulars of that work, but had only partially succeeded. It was commenced at the time when he (Mr. Scott) was engaged on St. Mary's, at Stafford, and, though he was not at the time aware of it, the course taken in the two works was nearly identical. The iron ties to keep the superstructure from becoming shaken, the mass of concrete surrounding the foundation, and the mode of renewing the surrounding stonework, seem to have been the same, though greatly differing in point of scale; and he observed, in a report made afterwards by the Dean, that here, as in other cases, the effect of the weight upon the timber shoring was such as to prove that there was no needless excess of precaution in the quantity of timber used. This work, and not that at Chichester, is the fair parallel to be compared with that at Bayeux as a specimen of English as distinguished from French works of this kind. In France, having government funds to deal with, no expenditure was spared; while in England, the works being paid for by private subscriptions, economy became of the first importance. We find accordingly that at Hereford, though the tower was of nearly double the weight of that at Bayeux, the amount expended was less than one fourth. The work at Bayeux, however, had evidently been carried out in a most masterly manner, and the book which described it was one which every architect would do well to study. The system of shoring seemed very perfect, and it was astonishing to think that a timber construction, apparently so simple, would sustain so great a weight in the entire absence of the piers below. The process seemed to be to needle the panels of the arches, or the work just over them, with needles of oak and wrought iron used conjointly; and again to needle

the arches at their springings. When dealing with buildings on the scale of cathedrals the difficulties of shoring become increased, for timbers were after all of a limited size, and it became necessary to *build* shores by forming a number of baulks (as 4, 9, or 16) into a single post, something as the masts of a man of war are constructed. The needles which supported the springing of the arches at Bayeux seem to have been so constructed by attaching together 9 square baulks into one huge post bound firmly together at intervals with iron. The mode of getting a foundation for the shores, too, by means of wells sunk down to a firm stratum, cased with cast iron, and filled with concrete (somewhat similar to an Indian contrivance he had heard of), seemed an excellent expedient where no firm footing could be procured near the surface.*

Mr. SLATER had very little to say after what Mr. Scott had so kindly said for him. It was peculiarly gratifying to him that Mr. Burnell had read such a paper, which he hoped would be published, as well as that lately delivered by Professor Willis, which he knew was to be published. With reference to Chichester it was unnecessary for him to say much. He was placed in a critical and most unfortunate position, and he had endeavoured to do his duty. It is true that his commission was to prepare plans for altering the choir only, and there were no funds, as had been stated, for making alterations in other parts of the work where they might be wanted. When the defects of the tower were found out and ascertained, he did all he could to avert the threatened danger, and everything that could be done was done with that object in view. He wished to say a word in reference to his friend Mr. Hills, who sat near him. That gentleman's name had not been mentioned by Mr. Burnell in the list of those employed, but he happened to be at Chichester when he (Mr. Slater) was engaged on the work, assisted him in every way he could, and, indeed, his services were most valuable on that occasion. Before he sat down he would just mention that in his office they had the charge of the restoration of Sherborne Minster, that two of the piers were taken down and rebuilt and the others underpinned, the whole of the work being successfully carried out. That case was nothing like that of Chichester, but there they found sound stone to deal with, whereas it was well known that that was not the case at Chichester, where they had to deal with nothing but a mass of rubbish. He should like to hear from Mr. Burnell in what state the stone of the piers at Bayeux was, for on that rested the parallel between Chichester and Bayeux. It was most gratifying to himself that Mr. Burnell should have so kindly come forward to discuss this matter in the paper which he had read that night. He must likewise say that the whole of the profession had behaved kindly to him under the very difficult circumstances in which he was placed.

Mr. BURNELL referred to the book on the Cathedral of Bayeux which lay on the table, and which afforded much better information as to the state of the stone of the piers than he could give. The heart of the piers was in a sounder state than the subsequent casing. At Chichester the hearting was inadequate and but rubbish, while the casing was comparatively good; at Bayeux the hearting was comparatively good, while the casing was comparatively bad.

Mr. GORDON HILLS, Associate, said he had to thank Mr. Slater for the kind way in which he had acknowledged his services. It happened that he had for some years been intimately acquainted with

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* Mr. Scott has had experiments tried on the strength of the stone from Quarr, in the Isle of Wight, used in the old piers at Chichester, and finds that, though weak, it bears double the weight stated by a correspondent of "The Builder." He has no doubt that that gentleman's experiments were tried on an inferior specimen. On taking down the two eastern piers the rubble work was by no means found so disintegrated as had been supposed, though formed of very small and bad materials. Mr. S. has also been informed that the tower at Sherborne Minster was repaired by the late Mr. Carpenter in a manner similar to that at Bayeux.

the Cathedral of Chichester, his acquaintance with it having commenced in 1846, when some extensive restorations were taken in hand. In a subordinate capacity he was connected with those works on the spot for the next four years. By casual visits his acquaintance had been continued down to the present time, and this acquaintance it was which had placed him in a position to attempt some service when he thought danger was approaching immediately before the late calamity. He would therefore offer some observations on those parts of the cathedral whose defective state or whose treatment have been supposed to have led to the calamity. The shrine under the Western arch of the central tower, called the Arundel shrine, had nothing to do with the main structure. The stone stairs behind it were not, in their latest form, of older date than 1829, and at that time the shrine, originally only a weak structure, was cut about and altered. There is strong reason to believe even, that at this time the western tower piers against which these staircases abutted were subjected to no very judicious treatment. At all events, when ten months ago he had the opportunity of inspecting the shrine and staircases, then thrown more open to view by the removal of the organ and its gallery, he ascertained that although close to the tower piers, the shrine could not afford them any support, and perceiving marks of great weakness in the south-west pier, which appeared to increase towards the bottom, he pronounced to a friend the opinion that the shrine and staircases ought to be removed in order that the state of the piers might be thoroughly ascertained. The removal of this shrine was at the time contemplated by the Chandler Memorial Committee for the sake of improved congregational arrangements, and the question had already been submitted to their responsible advisers, whether or not the removal could or should be effected. Under the advice of the cathedral architect and an engineer called in, the removal took place. The next occasion on which Mr. Hills visited the cathedral was also of a casual nature, on the 25th of January last. Since his previous visit, the shrine having been removed, extensive repairs had been done to the two western piers. Those to the north-west had been completed about three months, and amounted to a re-casing of nearly one-half of the faces of the pier from the bottom to within five or six feet of the springing. In this new work, near the bottom of the south face, he observed a vertical crack, 7 or 8 feet high, and which he was told had appeared immediately after the completion of the work; it was not, however, then so much as an eighth of an inch in width. In the south-west pier, where the new work had been confined to one angle, and to the bottom part, extending 12 or 13 feet high, he did not observe any failure in the new work, but a vertical crack higher up in the old work, perhaps an eighth of an inch wide, attracted his attention, and also he was struck by an appearance as if some old cracks had closed. Knowing well the want of strength in the original construction of the old walls, and the state of decay at which the old mortar had arrived, the opinion he formed from these observations was that the centre parts of the piers had commenced to crush. Mr. Burnell thought the foundations had never failed. They had, however, at remote periods sunk considerably, and had practically detached the tower from all the surrounding walls; the late movement was not one of foundations, but was within the piers above the foundation. He quite agreed with Mr. Burnell that the effect of the vibration of the spire had been altogether exaggerated. On the many occasions when he had ascended within the spire, including twice during the last week of its existence, no vibration was perceptible. Again, the swinging gallery, which Sir Christopher Wren suspended from the apex within, was a much smaller affair than from the observations he had heard, the public seemed to suppose it, and according to his view was intended much more to give weight to the cap stone and those immediately beneath it, and to carry that weight low enough down to avoid top-heaviness, rather than to exercise any balancing or pendulum effect. It appeared to him remarkable that this gallery, although in its upper stage only $1\frac{1}{2}$ inch clear of the walls of the spire, hung perfectly free on the Tuesday before the fall, showing that the spire then retained an erect position. The stone of which

the facing of the tower piers was constructed, and with which much fault had been found, was extensively used in other parts of the oldest work of the cathedral, and outside it stood the weather remarkably well. Mr. Hills thought it on the whole a good stone. It was probably brought from near Quarr Abbey, in the Isle of Wight, from the same quarries which had supplied largely to Winchester Cathedral and other buildings, and had stood the weather well in the oldest part of the Saxon church at Sompting. His connection with the attempt to maintain the spire was occasioned by his representation of his observations to Mr. Slater after January the 25th. Mr. Slater requested him to suggest remedies, and, having adopted them, appointed him to superintend their effect, taking the responsibility solely on himself. The plan determined upon was to encase the piers with a strong timber jacketing, to preserve them in their places till a system of shoring could be erected which should entirely relieve them of the superincumbent weight. The system of shoring contemplated was not very unlike that which Mr. Burnell has shown was used at Bayeux. We should not have been compelled to carry our supports to so great a height, but the weight we hoped to carry much exceeded that at Bayeux. We did not think of taking down any of the upper part beyond some parapets and pinnacles, certainly no part of the spire, and I must think that the success of the operations at Bayeux loses materially in its consequence from the fact that full 70 feet of the summit was taken down, which, although not of Mediæval work, was a remarkably good adaptation of Italian architecture, and if somewhat incongruous was a stately addition to the structure; this has been entirely sacrificed. In our last efforts at Chichester the failure of the piers was so rapid that no time was allowed to try the effect of the jacketing. Struts and shores between the arches, formed of timbers 12 by 3 and 9 by 3, bolted together in pairs, and about 25 feet long, were applied to restrain the bursting out, as it appeared in different parts whilst the jacketing was preparing. The rapid bending of some of these shores on the morning of Thursday, February 21, was the signal which led to the abandonment of further efforts on that morning, and to the recall of the workmen only a quarter of an hour before the fall came.

Mr. M. Digby Wyatt, V.P., thought that the period of the evening had arrived when it was proper to propose a vote of thanks to Mr. Burnell, which he did with much pleasure, and he was of opinion that anything more useful than such a practical paper as had been read that night being brought before them could not be imagined. The discussion which followed upon the paper, bringing out as it did the experience of some of their most eminent men, was not less valuable. The great matter was the consideration of the relative economy of the modes pursued in such matters as had been referred to. He thought the mode of proceeding in this country was more sensible, prudent, and not so wasteful as that which had been adopted in France of using such a mass of materials in order to take away four piers at the same time, instead of gradually proceeding with the work and adding sustaining strength to the piers as the operations were being proceeded with. The engineer of the building in France, which had been referred to, seemed to have miscalculated the strength of the structure he had to work upon. In the estimate given in the book upon the building, it appeared the foundations cost about £2,000., and they appeared to him the best part of this engineering work, and rebuilding the piers cost £15,000., just about as much more as the cost of sustaining the building to get the piers in it. Now that made the estimate of M. Viollet le Duc perfectly ridiculous. From what had taken place, he thought timber was not a material well adapted for shoring and supporting in great works like the buildings which had been referred to. If cast-iron had been used to a much greater extent in the work at Bayeux, it would have been found much more economical and effective.

Mr. Scott.—The work of Mr. Cottingham, at Hereford, was between 7000 and 8000 tons, about the same as that of the French cathedral, and instead of costing £32,000., as far as he could learn it did not cost £8000.

Mr. FERREY, Fellow, made some observations upon the nature of the stone used at Winchester Cathedral. An examination of this building would show that old masonry was not always defective. Undoubtedly there were in old times bad and careless builders the same as now, but in the case of Winchester he was perfectly certain that, if it was to be examined now, a totally different result would be discovered in that respect to what was found in the catastrophe at Chichester, and, had time permitted, he could have mentioned two or three other instances of the kind.

Mr. CHARLES BARRY, Fellow, seconded the vote of thanks to Mr. Burnell, and in so doing spoke of the exceedingly useful and practical nature of the paper which had been read, and which had brought up the valuable information communicated by Mr. Scott and others. Looking at the desire of the Council to make the Institute a museum of knowledge, he could not help thinking that much benefit would result if Mr. Scott would be kind enough to place in the library diagrams of scaffolding that had proved sufficient for the purpose intended, and of that which had not been sufficient. Some time ago he (Mr. Barry) had occasion to read before the Institute a paper on the scaffolding employed at the New Palace at Westminster, which, he believed, was the only one of the kind that had been read, with the exception of Mr. Burnell's paper which had been read that night, and he thought that if Mr. Scott, Mr. Ferrey, and other gentlemen would favor them with the results of their experience great advantage would be the consequence.

The CHAIRMAN, Mr. GEORGE GODWIN, Fellow, said he had had the charge of a case similar to those referred to in the paper. It was that of a large Norman tower in Essex, one of the piers of which was very bad, while all the other three were very good. He found a difficulty in getting in the large timber needles, and used 4 inch iron bars, which he had likewise done at some churches. He had found good oak timber very useful for supports. He then referred to a curious circumstance which he witnessed at St. Paul's. He once saw that when one of the monuments was being set up, every stroke of the mallet was followed by a cloud of dust.

The vote of thanks to Mr. Burnell was carried by acclamation.

THE DARK AGES OF ARCHITECTURE.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 10th, 1861,

By J. P. Seddon, Fellow.

I am somewhat afraid lest, by the title I have selected for this paper, I may have lured hither under false pretences some mistaken lovers of Mediæval architecture, in the hope of hearing a treatise upon their favourite phase of art; not I trust, that any could suppose that I am capable of endorsing the stigma upon it which such term was intended to convey; but it is possible that some may have thought that I proposed to enter the lists in its behalf in the character of an apologist. Should any have been so misled they must pay for their mistake by their disappointment, if such they deem it, for I hold that calumny to have been long ago refuted.

"The dark ages" to which I am about to refer are quite other than Mediæval as far, at any rate, as architecture and the other arts are concerned. They are those, the central or midnight century of which, if we may credit the historian Carlyle, lacked light in other senses besides the artistic; being, as regards political or moral honesty, also "bankrupt;" certainly in all matters of taste they were steeped in the deepest gloom. The picture I cannot promise to make inviting, but it may nevertheless be in some degree instructive, and show us what to avoid, a lesson not less valuable than that which teaches us what to study and adopt. As the dark ages of architecture do not then date from the birth of the art, they do not include, nor do they necessitate any inquiry into the probable form of the Wigwam of the "Pre-Adamite" man, if any such existed, and, more fortunate than Mr. Wallis's stone-breaker, had such a shelter while chipping his flint hatchets; nor need I trouble you with any speculations as to the early efforts of the *pre* or *post* Noahites, which, perhaps, some millions of years later may have preceded or followed the fabled transition of the type of the timber hut into that of the stone temple; for such essays in building cannot claim a title to the name of architecture at all; or if any be inclined to concede it to them it could be but as architecture in infancy, and, therefore even if only babbling by the light of nature, not altogether dark nor dead; its glimmerings, if but the first of the dawn, are surely, though slowly, perhaps, about to broaden into daylight; the men who wrought it were looking forwards and not backwards; they were gaining step by step in advance, never pausing; one nation taking it up where its predecessor left it; each meanwhile giving it some individual impress, and adding some new thoughts to the general stock, and fusing them into a consistent and intelligent whole. Thus we may trace art from age to age until "the Dark Ages," and find that it was ever a language wherein men simply and naturally expressed what there was in them to tell, and which we may read with an assurance greater than even that we can give to their written records, seeing that there is less likelihood of their having been tampered with. As, from the bowels of the earth, our geologists are digging new fossil facts, which explain or correct our misreadings of sacred writ; so our Layards and Newtons are excavating from more recent strata, actual fragments of buried Assyrian cities and mausolei, in Asia Minor, which in like manner throw new light upon profane history, and convict half our cherished traditions of being mere fables; putting us, as it were, face to face with the kings, priests, and warriors of those ancient days which had become to us almost as obscure as the "mornings and evenings" of the creation, with their wondrous intervals. So it is with the kings of Egypt; their acts and all that they did are chronicled on the walls of granite and

sarcophagi of basalt, lately visited and ably described by Professor Donaldson; and, in these days of railways we can quickly re-unite, in the mind at least, the sculptures of the Parthenon housed in our museum, to their empty sockets in the ruins of the temple or the Acropolis of Athens, and so gain a glimpse of that perfectly beautiful art in which the polished Greek sought to represent his ideal of the divine.

Then the Roman has left us his notions of architectural showiness, in his versions of the five orders, which, whatever they may be worth, were his own, until eclecticism in "the Dark Ages" confounded all nationality and propriety in such matters. Even the Byzantine, in whose hands art seemed to stagnate for a season, wrought out in his unmistakable manner the types which tradition handed down to him, and set the dome as his sign manual over the crux and each arm of the churches, which he built on that plan of his, "the Greek cross." The Arab, again, had his slim minarets and fretted domes, with an array of pointed and stilted arches whose curves seem to have been fashioned after that of his own falchion. The barbarians, also, who overturned the Roman empire and settled down upon its lees, gave sense and nerve to the effete nonsense which they found in the shape of decorative art in that classic land, and thought out for themselves a better (being the proper) way of using the archivolt, and wreathed the tame foliage of the Corinthian capital into something like the grace and freedom of nature; and told in their sculptures, without reserve, what they themselves believed in, loved, and were amused by. Then followed, surpassing all previous efforts, the Gothic or Mediæval development of art, the grandest, noblest, and most scientific which the world has seen; for even if, in its restless strivings after conceptions of beauty, seemingly as infinite in their variety as in the number of its works and its schemes for realizing them, it sometimes overshot its powers, and making not sufficiently sure of its substructure, in haste to soar upwards, prepared for itself such catastrophes as those recorded by Professor Willis of the towers of Winchester and Ely, and that just witnessed at Chichester, we have yet hundreds of other examples, equally fine, which have lasted for centuries, and may last as many more. We may therefore still be more thankful for its lofty and noble aims, despite such occasional failures, than for the lower, if safer aims of styles content to grovel near the ground, and whose superior science consists in poising huge stones upon columns in ignorance of the principle of the arch, whereby the space could be better spanned, and in avoiding every chance of thrust in order to escape a difficulty which they knew not how to deal with. Throughout all these several styles not one link in the chain was lost, not one lying phase had yet appeared. We may approve one more than another; we may find errors and backslidings; but no systematic and deliberate falsehood and betrayal of the spirit of the age can be found in the whole history of art until we come to "the Dark Ages." The Greeks seem to have been gifted rather with consummate refinement than with much originality. We can well see that they admired and borrowed from the ornament of Persia and Egypt, but we have no proof of their having attempted to build Egyptian halls in the streets of Athens, or sham caves of Ellora about its Acropolis. The Christians, when freed by Constantine from the persecution which had repressed all their previous efforts, boldly adopted the Pagan basilica for their churches, and built others after the same type; yet we do not find that they attempted to compose them out of porticoes copied from the antique, or that they piled Grecian monuments one above another, to serve for belfries or campanili. It is a question of the greatest moment to us, but one which I have not time now to discuss, how it was that the Mediæval or Gothic phase of art should, after its brilliant and rapid growth, have rested so short a time at the height of development which it reached, and thence declined with almost equal rapidity, till it "fizzed" itself away in France in the luxury of Flamboyant tracery, and in England was strangled in its straight-jacket array of the rigid Perpendicular.

It suffices for our present purpose to know that it died from inherent decay, and not from any assault from without. That this, as every other style that preceded it, should have gone the way of all things of earth may be a matter for regret, yet not of surprise; and its having done so is not the question which I have proposed to consider on the present occasion; but rather, how it happened that after it came "the deluge." We have seen that all previous styles successively rose, culminated, and fell, only to be followed by others still more comprehensive; and that each yielded up gracefully all that it had added to the general stock of ideas, to be grafted into the newer plant, to bud and flourish again with fresh vigour and increase of power under a fresh *régime*. What then necessitated the artistic chaos which reigned when Mediæval art vanished? What was the Gorgon's head which turned into stone the natural love for, and power to originate, beauty—which mankind had hitherto shown in all ages and countries? These are the questions to which I am anxious to find a solution. The complete quenching of the lamp of art which, sooner or later, in the period of the Dark Ages, ensued in every quarter of the globe (save where, among the less civilized Oriental nations, it has stagnated until now in considerable decorative purity), is one of the strangest phenomena I am acquainted with in the history of the world; and this I desire to invite you to consider, in the hope that we may be able to discover the rocks upon which it was shipwrecked, and that in our efforts to float it again we may be able to steer clear of them. "The Dark Ages," however, or at least the gloom of them, did not come all at once. The night, unlike that of the tropics, did not follow suddenly the light of the Mediæval day. Nay, the sun of art set so gorgeously that men were dazzled by the glory thereof, and believed that it was a sunrise, heralding a new better phase of art, instead of its being a sunset preluding the loss of the best the world had seen.

It behoves me, therefore, to linger over this threshold of my subject (and not unwilling am I to do so, seeing that it is by far the pleasantest part thereof), and to endeavour to trace the lines of its several changes as successively they grew fainter and fainter, together with the brightness of the evening stars of genius, which beamed like a galaxy through its twilight, and even, occasionally, long after the nightfall; until clouded over at last, utter darkness ensued; enlivened only by the false will-o'-the-wisp phantoms of *Rococo* which have been misleading men ever since. This period, then, upon which I shall now dwell, this twilight of "the Dark Ages" which I have taken for my subject, is that generally known as the Renaissance, or the revival of Classic art. It is true that in Italy, the whole surface of which was strewn with fragments of Roman work, Classic tradition seems always to have sat like a nightmare upon its architecture; the mighty flood of life which seems to have throbbed through the arteries of Northern Europe appears to have been checked in its passage through the gorges of the Alps, and to have exercised but slight effect below them, and never entirely to have succeeded in supplanting the influence of the Antique. It succeeded in doing so to the greatest extent in the thirteenth century; and with much grace for a time fused the two styles; but soon it began to hanker again after its old love, and we begin to find the mouldings of its Gothic buildings becoming poor and weak, and its parts and proportions betraying more of the Classic elements. In Venice, which, from its position, was not so strongly exposed to this influence, and which was greatly under that of both the Gothic and the Byzantine, we find in the Doge's palace a most valuable and nervous example of Mediæval building, unsurpassed in the boldness of its mouldings and detail; yet, if we consider the general aspect of the domestic architecture of that city, we shall find little of the variety which was so marked a characteristic of the Northern Gothic, it being similar in detail to that of the Doge's palace that we find repeated everywhere; while that of the churches of the Frari, and those of the same date are strikingly inferior. In Verona we find another most valuable local development of Gothic, particularly artistic in its treatment of coloured material and sculpture; still,

an under-current of Classicism is evident throughout Italian work. In the cathedral of Milan it has debased it so far as to render it only worthy of being a model for confectionery. In Florence and in Pisa we are so entranced by the wealth displayed in their buildings, of painting, and sculpture, and precious coloured materials, that we are consoled for the want of pure Mediæval feeling and boldness in the handling of the architectural detail in such works as pretend to be Gothic; and, in the hosts of false façades to the churches in the other towns, such as we see figured in the plates of the works of Hope, Gally Knight, and Street, we see foreshadowed the childish shamelessness of sham which mainly characterizes the later works of the Renaissance and those of "the Dark Ages," which ignores the certainty of being found out the instant the spectator turns the corner of the building. In the Loggia at Florence, by Orgagna, we find distinct traces of the Roman impost between the columns and the arches; while his Or San Michele, in the tabernacle and the tracery of the windows, presents us with work we might almost mistake for that of Batty Langley. In the pulpit by Andrea Pisano, in the cathedral of Pisa, we see in the figures and draperies of the bas-reliefs, evidences of an already too aborbing study of the antique, in contrast with the vigour shown in the beasts upon which the alternate columns rest, where the sculptor has evidently treated them *con amore*, and rather with the traditional Mediæval feeling; while the capitals of the columns are almost as bad as the Roman composite; and the weedy apologies for cusped trefoil arches are the only and faded traces of Gothic forms.

About the middle of the fourteenth century there arose a *furore* for the study of Classic literature (which, indeed, had been more studied during the Middle Ages than we generally credit, but then in a healthy way, as food to be digested and not so insanely bolted, after the manner of bookworms, as afterwards): antique manuscript became eagerly searched for and pored over by the *literati:* fragments of sarcophagi, and every production of Rome's New Road masons' shops were studied by sculptors, and voted to be admirable precedents: the ruins of the Coliseum, of the temples, of the Forum, and of the triumphal arches, were diligently examined, and their *proportions* measured, and admired out of all proportion with their merits; and, as ill-luck would have it, a somewhat dogmatical treatise upon architecture, by an old gentleman who lived during the unpropitious days when Augustus had just strangled the Roman Republic, and who was doubtless a highly respectable member of a very worthy professional body at that time, was just then brought into fashion; and a number of suggestions that he had made for the guidance of his pupils and professional brethren, whom he had the sense to see (for he was a very sensible man) were not to be trusted to think for themselves, were propounded as a code of laws to regulate architectural practice and to serve as canons of taste. The works of Vitruvius have since passed through many, perhaps too highly valued, editions, while a contemporary architectural romance, "The Dream of Polypholus," which is replete with artistic suggestions, has passed through too few. Most fortunately the painters were not so successful as the sculptors and architects in their researches after the antique; and thoroughly can we sympathize with Rio, who, in his "Poetry of Christian Art," rejoices that no picture by one of the celebrated masters of antiquity was brought to light; for, says he, "Had this been the case, modern art would have been in possession of a model from which an unalterable rule of taste and an unerring theory of the beautiful might have been deduced and applied to painting." It was owing to this want of success on the part of the painters, and to their being forced to trust somewhat to their own resources, that their art flourished longer than its sister arts, and that in dying it shone, as the dolphin is said to do, with brighter lines than during its life, casting not inconsiderable radiance over the decay of the rest.

It was, then, the unfortunate discovery, galvanizing, and deification, of the exhumed bones of

the *Classic*, or, to speak strictly, *Roman* art, which was the veritable Gorgon's head that paralyzed true and healthy art. Its influence was doubly fatal; first, by substituting precedent for thought; and, secondly, by substituting second-hand Paganism for Christianity. One result of the undue regard for precedent was, that *the people* (for whom artists ought to paint, sculptors to carve, and architects to build, rather than for their own compeers), caring comparatively little for the defaced bas-reliefs and broken columns, whose stories had become obsolete, and whose purpose was unintelligible to them; and the subtle mysteries of proportion being beyond their comprehension, or at any rate but a small compensation for the loss of the human interest and phonetic power of the class of buildings to which from Mediæval times they had been accustomed, began to lose all interest in the works which they saw rising around them. They found that these very learned architects shot completely over their heads, and that, when they asked for artistic bread, they got nought but stones. Certainly we do not hear of bed-ridden old men asking to be brought daily to look upon any of the master-pieces of the Renaissance, as had been the case with the campanile of Giotto at Florence, for, in truth, theirs are not "bright, smooth, sunny surfaces of glowing jasper:" they have no "spiral shafts and fairy traceries" for the eye to delight in; but rather uncouth, rugged, prison-like rusticated walls and frowning cornices, such as those of the palaces of the Strozzi and Ricardi at Florence, and of the Farnese at Rome, which plainly told them "we were built to keep you out;" and even if any from the love of novelty, should in those days, as some, I am aware, from force of prejudice, have, in these days, turned from the Doge's Palace and St. Mark's at Venice, to the contemplation of the Library, by Sansovino, on the opposite side of the Piazzetta, one would think that when the natural surprise at seeing so many almost identical females, angelic by virtue of wings alone, somewhat awkwardly cramped into every pair of spandrils throughout the building, had subsided; and when sufficient pity had been bestowed upon the Cupids in the frieze, each condemned to bear in symmetrical balance on either side of him a swag of flowers altogether too heavy for his size; that the proportions of the building, admirable though they may be, would not detain a spectator long after he had exhausted the iconography which is so happily suggestive of its literary destination.

The consequence of all this was, that the public ceased to ask for pleasure or instruction at the hands of architects, and the latter forgot that it was their duty to tender it, and, as if in revenge, hedged themselves about with a set of rules (the observance of which could, of course, only be appreciated by the initiated), in oblivion that art should "pierce directly to the simple and the true."

But the substitution of second-hand Paganism for Christianity was even more fatal than the slavish adherence to precedent. It is absolutely impossible to produce good work without faith in what one is attempting to realize. In such faith had lain the strength of the early painters, in whom we can excuse shortcoming in their powers of execution for the sake of the purity and earnestness of their aim; for, while men wrought in the spirit of the statement of Buffalmacco, recorded by Vasari, viz., "we painters occupy ourselves entirely in tracing saints upon the walls and on the altars, in order that by these means men may, to the great despite of the demons, be drawn to virtue and piety," and so long as the intention of works of art remained the same as that named in an inscription over the doorway of S. Nixier, at Troyes, viz., that three windows had been painted "pour servir de catéchism et instruction du peuple," we may foretell their success, and that step by step they will overcome the difficulties and technicalities of their profession without the aid of infallible precedents from the antique: but when they began to pander their art, at the bidding of princely patrons, to the representation of the labours and loves of Hercules and Venus, and other of the gods and goddesses of Pagan mythology, we may as easily prophecy that, notwithstanding such splendid genius and wondrous powers as those of the artists who congregated round the corrupt courts of Leo X and the

Medicis, the system has become rotten to the core: the lamp is but flickering with an unhealthy excitement, which but preludes the extinguishing of the light altogether. Such was the fact which ensued. The very prowess of Raffaelle and Michelangelo seemed to prevent their successors from making use of the powers they undoubtedly possessed. They prated of the composition, the drawing, the colouring, the chiaroscuro, of their great masters, and humbly strove to follow them with such success as they were able to command in these particulars; but they seemed, in their struggle after the means of art, to forget the true object and end of it, and one may commend their diligence so long as they confined themselves to the representation of subjects from profane history or mythology, seeing that it is of comparatively slight importance whether Alexander or Darius be caricatured or not in a picture which pretends to no accuracy, even in costume; or whether Juno or Venus appear questionable in point of character, if not of beauty, seeing that no one is called upon to believe in either their existence or their virtue; but one cannot but regret the misapplication of their efforts to represent the persons or scenes of sacred history. Thus, Caracci was far better employed upon his famed "butcher's shop" than upon his three Marys, weeping their crocodile tears, and Guido upon his Aurora amidst the clouds, for the future admiration of the dozen or so devoted students who may be always found copying the same, to the not very evident advantage of modern art, than upon his sentimental "Madonnas" and "Ecce Homos."

I have dwelt longer upon the effects of the Renaissance upon the painters than upon their brother artists, because, as I have said, from their fortunate failure in finding classic models, and the consummate excellence of some of their craft, the meteoric brilliancy of their fall was the more striking, and the warning it conveys necessarily the more patent; nevertheless, the same fate befel all the other arts, including that with which we are more nearly concerned, and to which my wasting space warns me I must now confine myself.

Let any one who would question what I have advanced, or who desires to study Italian architecture, and the end to which it led, in a simple spirit of common sense, take up Quincy's "Histoire des Architectes," and turn over the plates in their sequence: the first, representing the cathedral at Pisa, the work of Buschetto, in 1063, and the few next in order, he would find clearly demonstrating what I have stated as to the trammels by which, during even the Mediæval period, the attempt to introduce into Italy the architecture which was then flourishing beyond the Alps was restrained by the natural predilections for the antique. The plan of this cathedral—that of the Latin cross—its apsidal ends (reminiscences of the fatherland of its architect), its clerestory and ranges of arcades, and the Byzantine feature of the dome over the crux, are insufficient to conceal the preference for the horizontality of the Classic school, or to excuse the *mesalliance* of the Roman order with the arch. The latter is seen still more uncouthly in the baptistry, by Dioti Salvi, in 1152, where gables and crockets parodied from the Gothic are added. However, the fusion of the two elements, with greater skill, and so much beauty of proportion and treatment of precious coloured material as to demand admiration as a style *per se*, are represented by the works of Arnolfo di Lapo and Brunelleschi in the Cathedral, and of Giotto in the Campanile, at Florence.

In the palaces of the Medici, by Michelozzo, and of the Strozzi, by Cronaca, at Florence, we seem to lose sight of the desire to please, which the other buildings I have named show by their unsparing luxury of marbles and mosaic, and thoughtful delicacy of detail throughout, and are made acquainted with the stern grandeur and air of shrug the-shoulder affected by the turbulent and selfish Italian nobles of the fifteenth century in their fortress palaces, which, however, still depend, for no small nor inferior portion of their effect upon their almost Gothic treatment of the windows, together with the (to my mind) exaggerated frown of their heavy cornices of classic type.

Then, painfully evident is the study of the antique in the correct proportions, but tiresome monotony, of the arcaded side of the church of St. Francesco, at Rimini, by Alberti, each arch with its precisely similar sarcophagus, and each pier with its rectangular tablet, like a picture-frame, each spandril with its circular panel, like an *immortelle*, strangely commemorative, but hardly symbolical, of the career of the restless Sigismond Malatesta and his generals, who were probably not all cast in the same mould. How differently would such a theme have been treated in Gothic hands, let the monuments of Aymer de Valence and its neighbours in the choir of Westminster suggest, or the tombs ranged along the aisles of the church of the Frari, at Venice.

In the Palazzo Pandolphini at Florence we must needs bow to the consummate feeling for proportion wherein the genius of Raffaelle is portrayed, though I think we cannot but regret that he did not, as he might so well have done, give reins to his imagination, and treat us to something a little more phonetic than alternate segmental and triangular empty pediments. Yet, if we dare not do other than confess their perfection, we may plead that sufficient changes have since been rung upon this slender theme, with, alas! too seldom the same plea of admirable *proportion* for an apology which this building and that of the Palazzo Farnèse at Rome can undoubtedly put forward. The distinctions and merits of this Florentine, and the Roman and Venetian, types of the Renaissance, have been so well explained by Mr. Garbett in his "Rudimentary Treatise on the Principles of Design in Architecture," as to render it unnecessary for me to do more than refer an inquirer to his remarks on the subject, and simply to note, in following our present author, that we find, as examples of the second class, the works of Giulio Romano at Mantua, and of Michelangelo at St. Peter's, honourable, of course, to a greater or less degree, for *proportion*, but generally contradictory of truth in ignoring the necessity of floors in buildings by the use of single gigantic orders of pilasters for their exteriors, and for the method of veneering the same to their façades. Triglyphs, from the examples I find in the plates under examination, seem to be the main, if not single, idea of decoration; and for the pertinacity with which so happy a feature is kept before the mind, we ought, no doubt, though I own my inability, to be truly grateful. Of the Venetian type, by which I understand the decoration of each floor by an exterior order, we have the Library of St. Mark, by Sansovino, at Venice, of which I have already spoken, the Villa of Caprarola, and the Palazzo della Ragione, at Vicenza. But though we have not the noble Palazzo Grimani at Venice, by San Michele, nor any of the picturesque, painter-like conceptions of Longhena, such as the Palazzo Pesaro at Venice, which, if not so pure in detail, commend themselves to me for artistic grouping and conception before most of the ordinarily idolized Italian buildings; these Venetian works, with their pomp and luxury of effect, their successive orders of columns, constant use of coupled columns, depth of recess, and richness of detail, seem to typify the vanity and love of parade of the age which gave them birth, and which preluded the fall of the city they adored.

I do not remember ever to have been struck more forcibly with the character that architecture can present, than by the puerile vanity shown in many of these façades in Venice: for, while the old Moorish and Gothic palaces, marred as they almost all are by later incongruous additions and insertions, though comparatively modest and unaffected, have sensible fronts, more richly arcaded and decorated, of course, than the sides, yet in harmony therewith, so that they are one in conception and construction; these fronts of the Renaissance buildings are all separate, show façades stuck, as it were, before a building of totally inferior and distinct character, just returned round the angle a few feet, to save appearances, which of course is found out as soon as one has turned the corner. Such are the three grand types of the Renaissance architecture of Italy, as developed principally in Florence, Rome, and Venice, and whence sprung the architecture of "the Dark Ages" to which the

plates of the second volume of Quincy introduces us, but all the series of which I have neither time nor patience to follow.

From Italy the Renaissance spread into France, a result doubtless hastened by means of the Italian wars of Charles VIII., Louis XII., and Francis I., but at first the native workmen merely applied the more ornamental parts to their own Gothic work, as in the Château de Blois.

Subsequently they developed it into a style of their own, of which Chambord and Chenonceaux are among the most favourable specimens. It may be described as consisting of the application of pilasters, more or less enriched, as surface decoration; and these are, in fact, made to do the duty of the buttresses which were so profusely employed in Flamboyant. There is much beauty in this style, which was the work of French architects, and became naturalized in their land. It is very artistic, and less insolent in its display of barren proportion: it gives something more than that husk of art: at the same time it is, like all Renaissance work, radically wrong and inconsistent as architecture compared with the real styles. Its very notion of ornament is something added to, and independent of, the construction. It is highly picturesque, but generally exaggerated in its grouping, and skyline, and combinations of turrets and high roofs, its best features, which it borrowed from the Gothic.

In the latter years of Francis I. Italian workmen and architects were imported into France, and were employed at Fontainbleau. They introduced a great modification into the style, partaking more of the classic feeling, after which, as was natural, it rapidly deteriorated, and passed through the phases of the style of Louis XIV., set forth in the pages of Le Pautre, redolent of gilding and parade: thence it sank, in the times of Louis XV., into that vicious and emasculated style which has earned the soubriquet of "Rococo," in which all the manly grandeur, though somewhat heavy and impure, of its predecessor, gave place to an elaborate trifling with florescent knuckle-bones, in curious combination with a species of shellwork: altogether an idiotic piece of business, which we might dismiss without a thought, save of scorn, were it not that this, in the depth of the Dark Ages, was the very will-o'-the-wisp which architects and decorators danced after, and upon which, even so late as in the Great Exhibition of 1851, most of the productions of *civilized* nations were based, so that one had to turn to the works of the *barbarians* of the East, as to an oasis of true art, to refresh one's eyes with. Whether or not in the interval our efforts to imitate these on the one hand, and to teach the Chinese Palladian plasterwork, to smash palaces in Pekin, and to loot at Delhi on the other, may have turned the tables, we shall shortly learn.

The course run by the Renaissance in England we may take up at the period of Elizabeth; when the political troubles becoming settled men were able to turn their attention to art and architecture. For a long time the traditional construction and plan, and the mullioned windows, held their ground, but coarse bad Pagan mouldings were introduced as improvements, and an equally coarse sort of adaptation of French ornament was developed into a convenient store of precedents for "the Dark Ages." Stone was made to assume the appearance of cardboard, cut and curled, and monstrosities of every description were delighted in.

This Elizabethan style was that which in England combined the features of the decaying Gothic with those of the revived Classic, and though less refined in detail than the contemporary work in Italy and France, was, perhaps, the most vigorous and picturesque: in time, however, here, as on the Continent, the Classic element conquered in the struggle: purity of style and correctness of proportions, in imitation of Roman precedents, were the objects architects set themselves to attain, and so were ushered in "the Dark Ages." Yet many revered names there are among these architects, from whose reputation I desire in no degree to detract: I only lament that their lot fell

not in better times. What I seek to show is, not that Inigo Jones, Wren, Hawksmoor, and Vanbrugh were not great men, but that they were all the greater for having wrought out so much that is grand and graceful from elements lacking these qualities themselves, and which, when their genius was withdrawn, resolved themselves into the monotony and lifelessness inherent in them. Of the heroes who led this forlorn hope, Inigo Jones was the first and best. The proportions of his design for the portion of the Palace at Whitehall which was carried out are as generally admired as they are known; but, as it has been used as a precedent for myriads of acrobatic pilings of orders above orders, and breaking the entablatures over to give them some appearance of utility, we need the less regret in its not having been repeated by himself.

It is strange that one who so thoroughly appreciated the importance of purity and consistency in the style in which he worked himself could have so little regard for the same qualities in other styles as to have built to the old Gothic cathedral of St. Paul's, an incongruous pagan porch, and refaced the transept end in a manner which, fortunately for his reputation, lives only in tradition. This also has been much lauded for its proportions, but from the representations of it that exist I confess I cannot regard it with enthusiasm. That it was, however, simply barbarous as an adjunct to a Mediæval cathedral, we may, I think assume, from a comparison with the effect of the alterations made by another architect, who was not otherwise than a shining light, among the constellations of "the Dark Ages," to another of our cathedrals. I mean those made by Wood, of Bath, at Llandaff. Now, the works of this architect at Bath are by no means bad of their kind, and would not lead us to suppose that he could have been guilty of the atrocities which I fear can with too great truth be laid to his charge; any more than we should believe, upon less certain documentary evidence, that Inigo Jones had maltreated in a similar manner the façade of St. Paul's. Of the alterations to Llandaff I have enlarged the illustrations given by the Bishop of Llandaff in his work upon that cathedral, showing the design "as it was proposed to finish it;" and we learn from contemporary letters quoted by the Bishop, that it was proposed to pull down the two western towers and raise one over the front of the nave, as seen in the design, and "*then to finish with a rustic porch.*" Most fortunately the solicited contributions of the faithful were not sufficient to enable them to realize this conception. We learn, however, that they succeeded so far as to insert "*windows framed with wood of another sort, which will come vastly cheaper and look as well as the Gothick,*" and to finish the interior in "stucco" to their own satisfaction, for the same letter says, "*that the church inside, as far as it is ceiled and plastered, looks exceedingly fine, and is a very stately and beautiful room.*"

Sir Christopher Wren had by no means the same artistic feeling as Inigo Jones, though greater mathematical powers and science in construction; as an architect he had golden opportunities in the rebuilding of the city of London after the fire of 1666, and he had the genius to grapple with it in an engineering point of view, and architecturally also, so far as it was possible in the style with which unfortunately he had to deal. The manner in which he did this has been so lately thoroughly set forth by my friend Mr. Kerr, that I need not here enlarge upon his works; the more so, as my purpose of showing the thorough intractability of the style which even his talents could not overcome is rendered self-evident by the following remark, which I venture to quote from that gentleman's lecture on the subject. Speaking in reference to the double dome and screen walls of the nave of St. Paul's, he says:—"They are at least the makeshifts of marvellous ingenuity and still greater artistic power; they are falsities, it is true, but they are those of a master-mind; they are no common vulgar fibs, but grand lies of genius." Now a style that necessitates lying, which requires "marvellous ingenuity and still greater artistic power" to conceal awkward roofs and buttresses at the cost of making one half of a building a huge sham to render the other half tolerable, is, I think, fairly to

be said to belong to "the Dark Ages;" and that Mr. Kerr's estimate of the makeshift is a correct one, my reminiscences of a church in Venice, by Palladio, the roof and buttresses of which had not been concealed by such ingenious means, yet which seemed to call loudly for a similar friendly shelter, will enable me to corroborate. The group of the city spires and the towers of Westminster Abbey are conceived and massed with great talent and a true feeling for what is grand and picturesque; yet with such horrible details, such a substitution of the queerest pots and jars in the place of pinnacles; that it is necessary that one should half shut one's eyes to enable one rightly to appreciate their outlines; and as such are, after all, borrowed from the older Mediæval steeples, one would really rather open one's eyes and see true Gothic steeples with proper detail as well. The thin leaden spire of St. Martin's, Ludgate-hill, is, as a composition, rightly placed in contrast to act as a foil to the dome of St. Paul's, but in itself is surely no beautiful object.

Time fails me to describe other of Wren's works, or those of his successors who took up his mantle,—of Hawksmoor, Vanbrugh, or Chambers, and the rest of the band of that forlorn hope, despite whose efforts architecture sank down gradually to the uttermost depths of degradation, when the ideal of associated English homes was the monotonous dreary walls of Harley-street and such like—wherein Sham reigned triumphant from palace to terrace, in plan, construction, and decoration alike. Art and architecture became absolutely dark or dead; and copies or parodies of the works of other days were all that was attempted. The only merit that can be claimed for them is, as usual, that of "proportion;" an element certainly so essential that there can be no architecture without it; yet one the exclusive praise of which is a sure sign that there is little else to praise; just as the most sarcastic thing you can say of a man is to laud too highly his good-nature; the meaning of which usually is, to suggest doubts as to his sanity. To wade through the works of this dreary period, either for the purpose of description or reprobation, would be a task, the uncongeniality of which, together with the undue length to which I find I have extended what were intended to be prefatory remarks, must be my excuse for now shirking what might appear to be the subject I really undertook to treat upon. I cannot but own, however, that it is with some satisfaction that I find the ordinary limits of a paper reached without the necessity of an inquisitorial journey into the City for examples to criticise. In the first place, I am spared the necessity of becoming spiteful: in the next, a chilling reminiscence of the interior of St. Paul's indisposes me to revisit it until it shall have assumed—as we trust it soon may—*all over, and not here and there only*,—in the able hands of our honorary Secretary for Foreign Correspondence, richer hues, akin to those of St. Mark's at Venice; since we are promised the use of the same materials for its decoration. Then, it might have become incumbent upon me, however disagreeable, to sketch and measure the extraordinary sham portico set up by Sir John Soane at one end of the court of the Bank; to match, according to a favourite notion in the "Dark Ages," a real one at the other. Again, I had feared that it would be necessary to study the interior of Sir John Soane's Museum; which otherwise, not having a fancy to become a candidate for residence in that strange eclectic curiosity-shop, I had been content to seek amusement from in the illustrated catalogue of its contents.

I had also been afraid that it would be necessary for me to search and see how far I could agree or not with Lord Palmerston in his admiration of the several buildings which he was pleased to call Italian; and, as the Horseguards' was one scheduled in his list—the only pleasant features of which, to my mind, are the sentries in their uniform, who sit like gorgeous personifications of "Patience" inside—instead of "on—a monument,"—the prospect, I assure you, afforded me slight satisfaction.

I find myself, also, obliged to omit all consideration of the interesting question of the *Iconography*

of "the Dark Ages;" and all research into the origin of the type of cherubs who smile and weep in convenient alternation upon key-stones; or into the meaning of the lions' heads, whence flowers dangle to fill up panels; or into the purpose of the sundry pots that affect all high places. The question also, of the *Polychromy* of "the Dark Ages," I find myself obliged to omit or postpone, unwillingly, because upon this subject much instruction might be drawn as regards what should be avoided. The main ambition on this point seems to have been to keep on the safe side; and "*safe*" colours which could do no harm, and whitewash, reduced the interior of buildings to a similar condition of monotony to that we have remarked in the exteriors.

However, about the close of the last century, there appeared to be commencing a salutary "shaking among bones" (to quote again the phrase of Mr. Ruskin), in an artistic as well as in a political sense; and, though it seemed for some time difficult to discern whether these were real evidences of resuscitation among them, and whether such shaking were likely to bring any flesh upon them; we, at this period of time, are able to perceive (at least, we flatter ourselves so) that, through all the restless changes which have ensued in the successive fashions of copyism since then, there has been, beneath the outer garb of Greek and Elizabethan, of Roman, Florentine, and Venetian Renaissance or Mediæval revived styles which have met the eye, an under-current of healthy struggling to attain independence. Just before the Exhibition of 1851, in another lecture, I asserted my belief, in opposition to that of the author above quoted, that not bones alone were being shaken, and that we were upon a sure if slow route to progress. The coming Exhibition of 1862 will, it is to be hoped, by its contents, if not by its *carcass*, afford another favourable opportunity for taking stock, and another starting point in the road of progress.

What colours are the best to fight under, in the future struggle for the advancement of architecture in which we shall be all engaged, I must leave to the conscience and calm consideration of each.

As to what style may be the best to develope into a healthy, manly, Christian, English, Victorian architecture, I presume not here to dictate, since we differ in opinion on the subject.

It is well that we think not all alike, and are not content, as in "the Dark Ages," like sheep, to follow blindly a leader in all things. But let us fight out the battle, if battle it is to be, in a legitimate and friendly way; without deputations and special pleading on the one hand; yet without fear as to throwing stones, because both parties live in glass houses, on the other hand. Let each be thankful to the opposing side for pointing out its weak places, and turn manfully to repair them. There are plenty of what my friend Mr. Burges calls unnecessary "fizzings and crockets," and show buttresses, as well as vases and rustications and sham pediments, which may be offered up in a holocaust together; while there is equal room for each party to endeavour by practice to prove what their champions have been so vehemently asserting,—viz., the capacity of their favourite style to admit the highest art in painting and sculpture; and thus, whichever side conquers in the friendly struggle, both may rejoice alike, and the monotony and follies of the "Vernacular" style, as Mr. Scott calls it, which has descended to us as a legacy from "the Dark Ages," be left to the speculating builders who delight therein.

Mr. J. W. Papworth, Fellow, in moving a vote of thanks to Mr. Seddon for his paper, observed that, although it was lively in tone and might be useful, it was to be regretted that the author had not expounded the subject more especially with reference to one or two incidental points. Mr. Seddon was not alone in depreciating Vitruvius. He himself, however (the speaker), was inclined to ask how many copies of Vitruvius were in MS., or known to exist, and who made them. The majority

of copies were not of the thirteenth or fourteenth century, but of the twelfth, eleventh, tenth, and ninth centuries. His belief was that, if a little attention were paid to the subject, it would be found that the Mediæval architects of the eleventh and twelfth centuries thought they were following Vitruvius as closely as they could. He wished to know who it was who had taught the architects of the Middle Ages. Among the records and muniments of Italian cathedrals, constant reference would be found to the employment of German and other foreign architects, and recalled the idea that they were working on some unknown authority; and he believed that authority was Vitruvius. Many of their precepts were taken from Pliny, who had himself copied them from Vitruvius. He did not know indeed where the architects of the Middle Ages could have found their architectural knowledge, except from the pages of Vitruvius. With regard to the question of changes of style in architecture he thought Mr. Seddon had not given sufficient attention to the ruling point of *fashion*. So long as Renaissance was the *fashion* in France all the world voted it good, and in many cases imported architects from Italy to execute it. So again at a later period all the world adopted Batty Langley's Gothic as very good and very desirable.

Mr. Burges, Fellow, being inquired of, said he had never come across Vitruvius in Mediæval architecture. All he knew on the subject was, that he had not been able to trace him in eleventh, twelfth, or thirteenth century art. That he was extensively copied, however, there could be no doubt; and so were Ovid and Horace.

Mr. Street, Fellow, also said he had not been able to find any trace of Vitruvius in Mediæval works, and he thought that the revived study of this author's works had had a very prejudicial effect upon architecture.

Mr. Godwin, V.P., did not desire or intend to discuss the wide question opened, but he thought it right it should be understood that all present, though silent, did not concur in what, as it seemed to him, must be considered a general sneer at the great minds who in the sixteenth century, the period of the Reformation, the period of Bacon, had aided the world in the awakening of thought. He could not call that "a Dark Age." The tone of Mr. Seddon's paper did not seem to him quite wise: to underrate an enemy, did not elevate our own prowess. At any rate, those who had heard Mr. Seddon's paper would scarcely come to the conclusion that he had carried his "good nature so far as to amount to insanity." He (Mr. Godwin) did not yield to any in admiration of the works of the Middle Ages; still he did not think it should go forth, to foreign societies, that the Institute of British Architects were unanimous in depreciating all those mighty men who had laboured in the period in question, and who had left magnificent results behind them;—men—he, for one, was quite willing to admit,—whom he never contemplated without feelings of awe and admiration; and therefore it was he had made these brief observations.

Mr. Seddon said that he had no intention of sneering at the great masters of the Renaissance period, but he had a perfect right to express his rooted convictions,—convictions which he had always endeavoured to propound, because he believed all the hope they had of good architecture for the future lay in their comprehension of these points.

Mr. Kerr, Fellow, said he was not surprised that a gentleman who felt so strongly on the subject of Gothic art as Mr. Seddon did should express himself in such terms. There was, he thought, something more in the revived Italian architecture than Mr. Seddon was prepared to admit. The human mind never worked without materials; and it was absolutely necessary that at the period referred to it must have returned to the remains of Classic times. The human mind, turning to the remains of Classic Rome, found a system as different from that which had perished as could possibly be. It found, in the remains of Roman architecture, sculpture, poetry, philosophy, and history,

examples upon which it could with great credit to itself rely under the circumstances in which it was placed. These remains were adaptable to the wants and circumstances of the time; and nothing could have been more applicable to the cravings of the human mind when the Gothic had died away and left mankind in the lurch. How could the human mind have better formed a new style than by referring to these structures? and how could we in our day behold them without believing that the men who reared them were great men, and that the age in which they lived was not a "dark age?" How, he asked, could they look at the works of Michelangelo and Raffaelle and say that they lived in a dark age? Why, we who boasted that we lived in the light were but punies compared to them. History had its tale to tell, and it was predestinated. Instead of sneering at those who had gone before us, let us endeavour to trace where the human mind was true to itself, and let us see where we in our turn can be true to ourselves.

Mr. C. F. Hayward, Fellow, said he could not but approve of the fearless manner in which Mr. Seddon had stated his view. The entire gist of his paper lay in this consideration—what are we to do in the present day? He (Mr. Hayward) thought that, with a certain amount of common sense and true architectural feeling, it mattered very little what an architect studied where all the styles were open to him. He did not mean to infer that this remark would apply in a case where a particular style only was known; but now every style was open to the student; and, in days like these, when archæological societies threw so much light on the past, it was, he held, of little consequence in what school the architect studied; for, if he had a true architectural feeling and a taste for the beautiful, he would be sure to produce something which would be a step in advance. It was, he thought, only necessary to cast one's eye around the metropolis to see that great progress had been made even within the last ten years. In many parts of London and in the suburbs odd bits of carving or an arch would be found which he believed would be the landmarks to the date of that particular development to which we were looking forward as to an improved age of architecture. There was also a taste springing up for pure and useful construction, as evidenced in the use of polished granite, fine stone, and improved metal work. All these things afforded, in his opinion, ground for congratulation; and he thought that when a person like Mr. Seddon, who expressed his own deep-rooted opinions, came forward and expressed them boldly, he was doing a service to art; and he did not think such a person ought to be put down for thoroughly expressing his convictions. Holding these views, he had great pleasure in seconding the vote of thanks to Mr. Seddon.

The Chairman, Mr. Digby Wyatt, V.P., in putting the vote of thanks, observed, that he had heard with pleasure in a paper, with the conclusions arrived at in which he personally was unwilling to entirely concur, that its author had not failed to render a just tribute of admiration to much of the art of the ancients. He was, he admitted, unable to trace the logical consistency of a writer who, while admitting so much, stigmatized as "Dark Ages" those in which an honest and most vigorous effort had been made by many of the choicest spirits the world had ever known, to preserve and adapt for use by the moderns all that they could rescue from oblivion amongst the mouldering relics of antiquity. If men were to dispassionately examine what really constituted the basis of much of the beauty of Gothic art in the thirteenth century, it would be found that Classic traditions reigned among the "magistri operum," not in the dogmas of Vitruvius alone, but in many technical traditions derived from Classic times. Mosaic, enamelling, the masonic art, and fresco and other modes of applying colour, for instance, were handed onwards from the earliest period; and when they remembered how grand an addition sculpture gave to architecture in the best periods of Gothic, and the extent to which Nicola Pisano and the other great revivers of the art built upon the monuments of ancient Greece and Rome, they could form an estimate of how much Mediæval

architecture was indebted to the Classic. If, for instance, the sculpture in the old monuments of the eleventh and twelfth centuries in the South of France were referred to, it would be found that it was almost all bad. It was like a mean imitation of the antique, because it was far removed from the source of inspiration. If, on the contrary, we approached the monuments of districts in which the more spiritual element, based as to all that was really valuable on the tradition of the antique, had prevailed, we should find the highest class of art. In the time of Nicola da Pisano a new light sprang up, and there was great beauty in his works, and in those of Luca della Robbia, and a multitude of other masters of the revival. So, too, with regard to painting: those who came after the masters of the art of illumination, adopting general Mediæval characteristics, such as Fra Angelico da Fiesole or Gentile da Fabriano, Cimabue, or Giotto, were very admirable in their way, but they never approached to the grand style of those who succeeded them. So onwards to the time of Perugino and Raffaelle. What, after all, were they to compare with Raffaelle, Leonardo da Vinci, Michelangelo, or Titian? He confessed he was surprised to find Mr. Seddon speak in terms of disparagement of an age which produced such men. It was not enthusiasm nor feeling for art which Mr. Seddon lacked, but it was a reverent and catholic spirit that was wanting in him. It was not desire to excel nor originality that he required, but breadth and strength, flexibility, and the power of eliminating beauty, wherever it might exist, without prejudice or bias; and it was alone by turning their attention to developing these catholic elements that he or any other artist of the present day might hope to become great masters, like to those who flourished in what Mr. Seddon had, as he thought mistakenly, called the "Dark Ages."

The vote of thanks was then put from the chair, and carried *nem. con.*

ON THE PROPOSED EMBANKMENT OF THE THAMES.

By James Edmeston, Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 24th, 1861.

I can think of no subject more important in itself, or more interesting to the members of this Institute, than that great constructive and sanitary problem which for so many years has occupied the attention of successive Governments; of many of the most enterprising members of the scientific world; and indeed of the inhabitants not only of this metropolis, but of the country at large; viz., the improvements of the banks of the River Thames by an embankment; and, at this moment, the best way of forming an intercepting sewer.

In dealing with this subject I desire to say only as much as may be necessary to bring forward the main features of the different schemes so as to provoke an instructive and interesting discussion upon this occasion; and I must believe that should this meeting come to an expression of definite opinion upon it, it will be received with all respect out of doors, and be by no means without influence upon the public feeling in this matter—or even upon the pending Report of the Royal Commission now sitting. If I may use such an expression, the honour of this Institute is to some extent compromised if it could be possible that so great and important a work should be prominently under public notice and yet receive no attention from us (as a public body), who ought to have so much at heart every question bearing upon the improvement of this metropolis; particularly a question like this, which has much more than a mere engineering element in it.

I do not propose to say much about the intercepting sewer: that is certainly almost entirely an engineering question; and, if an embankment be formed, no matter how, there can be no great difficulty in forming the sewer in, under, or through the embankment; or, if the embankment be not formed at all, of iron pipes along the fore-shore of the river; and I also confine myself to the north side of the river, as there is no immediate prospect of anything being done at present with the south side.

The question of the embankment must be met with reference to certain other requirements and peculiarities involved; and the broad issue here to be raised is, as to how this great improvement can be effected so as best to fulfil these requirements and to meet these peculiarities: thus—

1. Provision must be made efficiently to relieve the crowded streets, and also to improve the navigation of the river.

2. This must be done with a due regard to existing interests of very great magnitude, which must be affected as little as possible; since, if these are disregarded, an insurmountable obstacle is raised to the desired work,—*the* obstacle, in fact, which has hitherto defeated its performance.

3. Constructive difficulties must be overcome,—by which I mean that they must be dealt with so that the expenditure is within reasonable bounds.

In these days it may be said that nothing is beyond the reach of engineering skill; but the real triumph of the engineer and architect is to achieve the work before him not only most effectually, but with only a really needed and commensurate outlay.

Before proceeding to note the chief points of some of the various schemes which have been

proposed to solve the problem before us, a word is due to Sir Christopher Wren and Sir John Evelyn; and again, more recently, to Sir Frederick Trench, who, in 1828, advocated a plan of an ornamental and architectural character, based chiefly upon philanthropic and popular views of the subject; and also to the more comprehensive scheme of Mr. John Martin (which he laid before this Institute in 1856), and in which, with the provision of an intercepting sewer, he combined an embankment and great public promenade, with a view to relieve the streets; which, however, are now far more overcrowded than they were then. He proposed intercepting sewers or receptacles, in portions of a quarter to one mile or more in length; these receptacles having a width of about 20 feet, and being formed close along the existing quays, or in the embankment, which latter would run close alongside the present shore. The sewage was then to be pumped into elevated receptacles or close barges; and part of the scheme provided for its distribution in rural districts. Over the embankment colonnaded wharfs upon the quay were to be formed, so that the wharfingers would have a private use of the quay; and the colonnade supported a promenade, which it was thought would be a great public boon. At the present time it is universally considered that there must be not only accommodation for foot passengers, but for a large carriage traffic; and it is nearly as universally agreed that this will not meet the case, but that there must be a railway as well.

He also proposed floating piers attached to the embankment, forming docks for the barges; the whole plan being in many respects very ingenious, and calculated to answer its purpose. At the same time, Mr. Walker, Mr. Page, and Sir Charles Barry, proposed schemes to the special committee of the House of Commons; and of their plans Mr. Page's was, in 1844, adopted by the Government, and great exertions were made to get it carried out. The schemes of Sir F. Trench and others failed, partly because, being mere extensions of the river bank, they totally destroyed the wharf property; and Mr. Payne was, I believe, the first who proposed to detach the embankment from the warehouse frontages and to form docks within it,—or rather not distinct docks, but to leave almost an entire water space within the embankment. At this time it would seem that no apprehension of the evil consequences of turning the sewage into the Thames was felt; for it was only intended in these schemes to continue the sewers under the embankment, and to allow them to discharge into the Thames as before.

Mr. Page's estimate of the cost of his scheme was £366,000.

In 1855, the select committee of the House of Commons on Metropolitan Communications received much valuable evidence upon that subject; and among others, Mr. Lionel Gisborne proposed to embank the Thames from Westminster to London Bridge; but, beyond Blackfriars, to construct only a quay wall; giving the river a uniform width of 700 feet; the foundations to be laid 20 feet below low water upon hollow iron piles, as at Rochester and Chepstow bridges; with tidal basins. He proposed also an esplanade for foot-passengers, 20 feet wide, covered with glass from Westminster to Paul's Wharf; behind that a range of residential buildings 50 feet wide; behind that a road 200 feet wide, with stacks of warehouses 60 feet wide. The cost to be about two millions. Also a similar construction of road shops and houses, and tidal basins, on the south side.

Other schemes were proposed before that Committee; but which, as well as Mr. Gisborne's, were again produced before the Committee of 1860; with the proceedings of which we have more particularly to do, as leading at once to the present position of the subject. Of these schemes almost all were conceived upon the principle that the right mode was to make an embankment a long way into the river, so as to reduce its width by many hundred feet in some places; and behind, to have docks or tidal basins for the use of the wharfs. These schemes are all by men of great eminence in their profession, and are conceived in the most comprehensive spirit. In the main idea they are alike; but they vary in their details.

The mode of construction is also similar. It appears generally agreed that the hollow cylinder and iron plate construction, which has been adopted at Westminster Bridge, and at the Victoria Dock, Fresh Wharf, and other places, is the best. Thus, the iron cylinders, with grooves on their sides, being driven well into the earth every six or seven feet, $1\frac{1}{4}$ iron plates, strengthened by flanges, would be filled in, and thus a cofferdam would be provided; then, by means of a cross wall, a chamber might be formed, the water pumped out, the ironwork backed up by brickwork and concrete, and the embankment be completed. One gentleman, however, preferred brick and granite to iron for the quay walls, as it is said that the iron becomes so brittle in frosty weather as to be easily injured. I am alluding now to the schemes of Mr. Bidder, Mr. Jno. Fowler, Mr. Bazalgette, Mr. Bird, Mr. Page, and Mr. Gisborne. Viewing these more in detail, we find that Mr. Bazalgette proposed an embankment with a roadway 100 feet wide, upon iron columns, high enough to give access to the docks two hours before and two hours after high tide. The total cost was estimated at about one million.

Mr. Bidder also proposed an embankment with roadway on brick arches of 86 feet in width; but the embankment is in all about 180 feet wide, and the road passes all the bridges, except Hungerford, on a level. On the surplus space warehouses would be built, with shops at the level of the road; and the docks are entered not only by gates, but by locks; and it is intended that craft should thus have four hours before and four hours after high water to enter and leave the docks. In certain places where docks could not be got, craft would lie along the outer wall of the embankment to load and unload. The estimated cost is one million and a half.

Mr. Gisborne proposed a road 70 feet wide; and craft would go in and out of the docks two hours before and two hours after each tide. The cost was estimated to be £1,200,000.

Mr. Fowler proposed a road 100 feet wide, and parallel with it a railway; so that the space left for the docks is less than in either of the other schemes.

Mr. H. H. Bird also combined a railway with his scheme, running nearly at the low water level. The docks are reached by means of aqueducts across the railway, both with tidal gates and locks. The tidal gates give a free entry $1\frac{1}{2}$ hour before and after the tide: its estimated cost was £733,000., including the railway.

Mr. Sewell submitted a scheme for a railway only 11 or 12 feet above high-water mark; the railway being carried on screw or hollow piles, so that craft could pass underneath it to the wharfs just as at present.

If the six great schemes (the merest outline of which I have already described) are correctly based upon the assumption that a system of docks is the best way to provide for the rights of the wharfingers, there is little more to be said; for, without doubt, they develope in the most complete manner all that can be done to that end. I, however, after much enquiry and much consultation with those well able to judge, came to the conclusion that the provision of the docks was an entire mistake, and that a simpler plan would be more efficacious, much less costly, and more likely to avoid that rock upon which all previous schemes have foundered,—the rights of the owners and tenants of the river-side property.

These parties at present enjoy the river itself as the great highway, always free and open for their use, the traffic upon which is carried on in cumbrous barges, most of them navigated without rudders, and not easily guided through tidal-gates and locks under any circumstances, but which could only with great difficulty be so managed in a rapid tide, the velocity of which would be increased if the sectional area of the river is diminished, and which could not lie outside an embankment projecting very far into the river without obstructing the navigation, and being also liable to get injured or swamped.

Unless also each occupier of an existing wharf had at least a water frontage equal to what he at present enjoys,—and that within a very moderate distance of his warehouses,—he would have cause to

complain; while, if he had to cross a public way, and if this frontage was not in his private or sole occupation, it would really be almost useless to him.

Further, anything less than the maintenance of one large dock, from end to end, behind the embankment, must diminish the water frontage of some directly, and of all indirectly. Again, a main object of the embankment is missed if the banks of the river are exposed at low water. But would not the docks be receptacles in which there must be a considerable sediment? Are not all docks invariably more or less offensive? Or, if you must have the docks, instead of the river itself, it will be said, "they may be cleansed." No doubt. But who is to do this? Who is to bear the permanent expense, not only of that, but of attending the gates and locks, and of repairing and keeping them in order, which would altogether be no trifle? Unquestionably it is more advantageous to the wharfingers to come to the river front, where there is unfettered navigation; and it must be remembered that at neap tides there would often be less water by some feet over the cills of the dock gates than has been calculated in the several schemes. It is desirable that no part of the bottom of the river should be uncovered at low water; but what is the gain of going out hundreds of feet into the river, and narrowing a noble sheet of water, some 1,000 or 1,100 feet across, to the 600 or 700 feet which it has at Southwark Bridge. When the sewage is taken out of it, there will certainly be nothing to regret in its broad expanse; and it must be admitted that to go far into the stream, even with all the scientific aids at command, must be to incur a far greater expense than to go only a moderate distance. With these views I proposed to the committee of last year a scheme, according to which the claims of the wharfingers for disturbance would be reduced to a minimum: they would each have still the use of the river, with a direct and private access to it, and that at no great distance from their existing premises; while they would get under the roadway stowage room, which in itself would be valuable; and at the same time the required public road would be provided, and the streets would be relieved, and at a cost which must be far less than if the construction went as far again into the river, and required docks to be made as well.

It may be said that a construction only some 15 or 20 feet above high-water level would not give the river that architectural magnificence which it might gain from a design which would combine the erection of large piles of building. The intended roads would, however, almost hide any such buildings; and I think that question may be much more safely left to time and the ordinary course of events. The river-side is far more likely to gain a picturesque aspect as each warehouse becomes rebuilt separately from time to time; for in these days the exhibition of architectural feeling and taste may almost be said to be sought after and considered necessary, even in buildings for the merest business purposes, such as workshops and the like; instances of which I might easily enumerate if it was necessary.

All the above schemes have been reproduced before the Royal Commissioners now deliberating, and who have not as yet made any report upon the subject referred to them. But there have, also, been some other schemes brought forward by Mr. Brooks, Mr. Weller, Mr. Bardwell, Mr. Aicken, Mr. Sich, Mr. Newton, and others, which, as no access can be had to the documents in possession of the Commissioners, it is impossible to describe. I can only hope their authors are now present to do so.

Mr. Sheilds has also submitted a plan for a mere roadway, 80 feet wide, in front of the wharfs and warehouses; which, I fear, destroys them. And I cannot see why their owners should not have the private use of the river side, as I have suggested, while the road itself is provided very nearly in the same position.

I do not pretend to predict the decision to which the Commissioners will come; but it is currently

reported out of doors that they will decide against all the great schemes, and in favour of some plan which, like that of Mr. Sheilds, is simple in its character, and comparatively inexpensive.

In this place it is impossible not to say something of the style to be adopted. In the several schemes I have mentioned this appears to have been very little thought of. It would not, however, be fair to criticise the designs architecturally; for, no doubt, their talented authors regarded that as only in the faintest way connected with the great work. We, however, think differently, and ought not to allow a silent indifference upon the subject to give colour to an impression, general enough among the public I have no doubt, that in such a matter an architect was somewhat of an interloper. The designs comprise arcades, most extensive columnar arrangements, and massive buildings. We have most favourable circumstance of position,—the majestic river covered with its many vessels—a most picturesque line of foreground; here, public buildings of the most important character; there, ornamental gardens and pleasure-grounds; the piles of warehouses and residences,—an every-varying panorama, not laid out in a straight line, but curved, and to be viewed in an ever-shifting perspective at almost every point. What is wanted but the master-hand and artist mind so to deal with all this as to make it a picture of architectural richness never equalled in the world? The mixture of busy life with the gaiety of the pleasure-seeker, the view intercepted by the many bridges—railway and other; the vistas beyond,—the lights thrown back from the water,—the deep shadows and mirrored reflections in the purified stream;—I say that this is, of all others, a theme for the architect; and I would that we, as a body, were more alive to the necessity of not allowing these great opportunities to pass without striving for the victory, even with giants such as those I have named.

I will not pretend to argue in any way the style to be chosen. For my own part I would say, let the buildings be broken into masses; but let there be an element of repose, of conscious strength, if I may so speak, in the work which sets bounds to the mighty river; let there be simplicity of treatment with broad effects; not much ornament,—not any breaking up of surface with small projections; and, whatever may be the leaning in the architect's mind towards any particular style or period or art, it will matter little: the result will be sure to satisfy.

Finally, let me express a hope that I have stated fairly what little it has been possible to say within the compass of this brief introduction of the subject, concerning the schemes that I have alluded to; and let me add that a tribute of admiration and praise is due to their authors for the public and spirited way in which they have come forward at the expense, not only of large pecuniary outlay, but of very great thought, labour, and cost, when the nation asked for information as to what was to be done; an expenditure, be it borne in mind, which, in most cases, must be without any return whatever.

Mr. Newton, Fellow, observed that the very few words he had to say upon the subject would have reference to the important part which architects were called upon to take in this great question. The Institute were in possession of information on the subject such as he believed no similar body possessed on any subject of the kind. The Thames Embankment was no doubt an engineering question, and engineers were in the habit of looking upon architects as interlopers in matters of this kind; but it should be remembered that if the engineers had more combined themselves with architects they would have done more than they had done for the public good. The question was, whether there were to be buildings or not in connection with the Embankment. That was regulated by the individual views of the authors of the schemes proposed, but with regard to the Institute they possessed a larger field of action, and had nothing personal to deal with. They should have taken up a right position beforehand, so that by what was done they might arrive at a work of greater magnificence than anything before executed. He begged to express a hope that if anything in the shape of buildings

was to be part of the plan, the Institute would interpose by submitting a memorial or sending a deputation to the authorities, or in some other form, so as to throw some energy into the embankment question.

The PRESIDENT thought Mr. Newton, had a suggestion of his own to make, the drawings illustrating which were before the meeting, and probably, therefore, he would be kind enough to explain his views.

MR. NEWTON said that his plan consisted of a viaduct with a series of arches, of 25 feet, with central piers, through which an intercepting sewer was to run; and if the top of that sewer were kept below high water mark, the barges in the river would be able to pass over it to lagoons behind. From the variation of tides a few extra openings of greater extent would be necessary, at intervals.

MR. T. H. LEWIS, Hon. Sec., asked if Mr. Newton proposed to have buildings on the embankment, and at what level?

MR. NEWTON replied that he proposed to have buildings at the level of the lowest bridge in London,—except at Waterloo Bridge, where there must be an ascent and descent; but a drawbridge might be introduced at that point if necessary. He added, in reply to Mr. Lewis, that his viaduct at the Temple Gardens would be about the same level as at present.

MR. TURNER, of Dublin, expressed his gratitude to the profession for the privilege afforded him of expressing his views. His proposed embankment commenced at Westminster Bridge, and at Whitehall there was an esplanade for pedestrians, with a gate opening from each of the mansions there. In continuation from thence he proposed a street 90 feet wide (and the same at Waterloo), and in addition a low level street of 33 feet like Thames Street, with communications from the one street to the other; the lower level street being for goods traffic, which should not get on to the other. He proposed to complete this in two years, by means of iron piles, 20 feet apart, driven into the London gravel. The great sewer was proposed to be outside these works, and in addition he had made provision for a railway, in case it should be required by the increased growth of the metropolis; and the plans [to which Mr. Turner referred] showed a double railway for passengers and goods. Mr. Turner gave some further explanations of his project referring to his models and drawings, stating that he had provided every facility for discharging the cargoes of barges, and for the accommodation of Somerset House and the Temple. It would be seen that he proposed to have a winter garden at the Temple, and a place where volunteers might be drilled.

MR. J. J. COLE, Fellow, said that the question was one of much difficulty. Living so long as he had in Essex Street, he knew that there would be great difficulty in getting the barges into anything like the 25 or 30 feet docks. Again, he knew something of the swell of the Thames, which would be a great drawback. Mr. Turner had proposed an intercepting sewer, in connection with the Embankment, but he (Mr. Cole) thought that anything like that would make the river worse than it was at present. There was now a scour about the bank of the river, but that would be stopped by the proposed docks. He thought the straw barges particularly would be unmanageable, because they have no headway to get into the wharves. As regarded appearances he should be sorry to see the river unnecessarily narrowed, and anything like a detached roadway would take away one of the great charms of London, as seen from any of the bridges; therefore his own feeling was that an increased width of the present wharves would be better than any detached road or viaduct. He did not wish to prophecy, but he certainly did not think that any of the schemes before the meeting would be carried out. Living as he did almost next door to the Temple, he knew that the Benchers would not like the formation of winter gardens or volunteer practice grounds, and it would be a pity to shut out the view from the Temple Gardens to the river by a lofty viaduct. In his opinion London would look

much better if grand *warehouses*, rather than *shops*, were erected along the line of the embankment. The design of the late Mr. John Martin, the painter, was exceedingly beautiful and pictorial as a work of art; but it had previously been brought out in the year 1832 or 1833 by an *architect*,—viz., Mr. Samuel Angell, and beautiful as Martin's drawings were, it ought to be put on record that *an architect* was first to propose an embankment, and an intercepting sewer. Some of the plans proposed to carry the embankment *above* the level of the Temple Gardens, and it might be very tempting to do so in connection with the proposed street to communicate with the new Law Courts; but, for himself, he thought there should be nothing, which should intercept the view of the river from the Temple Gardens.

Mr. G. Burnell, C.E., said that he had hoped in coming to the meeting that the question would have been discussed in a philosophical way; and it struck him that the subject of the Thames Embankment was suffering from a want of discussion in that way. The question was not solely as to what might be done between London and Westminster bridges, but it involved the navigation of the river and the stability of all the property from Teddington Lock to the Nore. From all that he had seen and read the question had never to his mind been considered in that point of view. The river Thames had a very peculiar law of tides. As far as regarded the supply of upland waters it was an exceptional position, and the condition of the deposit of alluvial matter in the Thames was also peculiar. The extraordinary position of the locks and mill-dams in the Thames must retain alluvial matter which would otherwise be brought down, and if the shoals were properly examined he believed it would be found that the alluvial matter in them came rather from the sea than from the land; and all these things required to be taken into careful consideration with reference to the embankment of the river. Before the removal of the starlings of old London bridge the tide could not flow up, and by the removal of that bridge all the other bridges were seriously affected; he would not even except Waterloo bridge, for he knew that it had been necessary to throw in materials to protect the piers. If the operations now proposed for embanking the river were carried into effect, the consequence would be that the flood tide would flow up with much more velocity than at present, and then one of two things would occur; either the flood would carry with it and deposit in the upper part of the river more alluvial matter than at present, or if the river flowed out again with sufficient velocity to take away the matter deposited, it must deepen the present bed of the river, and all the existing structures on the banks of the river would be seriously affected. In all the discussions which he had heard on this subject neither flood nor ebb tide or alluvial matter had been alluded to in any way whatever. Some of the schemes were illustrated by most artistic drawings, but the question had been dealt with as a matter of art, and without regard to what Mr. Newton had called the engineering question. That gentleman had not properly regarded the principle of directing the current by cutting off the large concave portions of the river, where the water was shallowed, and did the least good for deepening the narrowest part, because the principle ought to be to shorten the course of the river, and to drive up the current so as to deepen the bed. With regard to the other schemes for making a sewer, he might observe that lately it had been his fortune to have a good deal to do with the banks of the river, and he had been struck with the observation that the water coming out of the sewers was (as compared with the river itself) in a state of remarkable purity. He did not think therefore that there was much to be feared from the amount of impurity which the sewers would deposit in the proposed docks or canals, because the latter would be filled from the Thames, and not from the sewers. The point which seemed to him to over-ride the whole matter was this, that the gentlemen who had hitherto presented to the public schemes for the embankment of the river had confined themselves to the limited space before them, leaving out the broad and general system; and so long as that system prevailed he felt that with regard to the Thames embankment they should be obliged to do as they had done in all their great works in London, viz., to do them over again.

The PRESIDENT said that during the last twenty years he had heard a great deal of this question, and he quite agreed with Mr. Burnell that it had never been approached in the phase in which that gentleman had presented it. The history of whatever embankments of the Thames had taken place, so far as he knew, was this, the Corporation of London, being Conservators of the River, finding themselves applied to by various proprietors for embanking their frontages to the Thames, applied to Mr. James Walker to give them a plan of the river, and to mark upon that two lines, North and South, to which extent he would permit embankments, and not allow them to go further. What Mr. James Walker knew about the subject he (the President) would not say, but Mr. Walker was assisted by a very clever and sensible man, Mr. Bullock, and between them they laid out a line showing the extent to which persons might be allowed to embank the river, and that line came to be known and was still known as Walker's line. Subsequently, when the Crown and Corporation of London got into litigation as to who had the right to the bed and soil of the river, the Crown lawyers of course imagined that a great deal was to be got out of it, and at last the lawyers consented that Walker's line might be adopted, but that it must be regulated by a line which had been laid down by the Government engineer, Mr. Page. Mr. Page knew nothing about the river, and he laid down a line which of course differed from Mr. Walker's, and of course everybody going to the Corporation got Walker's line, and those going to the Woods and Forests got Page's line. The two lines did not differ much, and it was referred to Mr. Higgins, and it was ultimately agreed to in a Parliamentary Committee that the Thames might be embanked to the extent of Walker's or Page's lines, but they never gave any reason why that in some places it was to be deep and in others shallow. The report of Mr. Page, with the charts annexed to it displayed great ability, and showed that he knew where the deep water of the river ran. His own opinion was that Mr. Page's line was more philosophically laid down than Mr. Walker's, because Mr. Page had reasoned more upon the facts he had ascertained, and had produced sections of the river showing the changes which had taken place by the removal of the bridges. There was no reason to suppose that either line was a bad one, but then came the question which had been shirked by everyone on all occasions, but which had been adverted to by one gentleman, namely, what was to done with the barge owners' interest. The barge owners carried on a large and important trade by means of lighters without rudders, straw barges, billyboys, and other vessels, running up and down with the ebb and flood tide, going in as they can to the several wharfs to which they are bound, and settling down upon the bed or shore of the river till it suited the owner to discharge the cargo. This was the difficulty which destroyed the bill of the Government, because it was impossible to deal with the barge owners without buying their trade out and out. One of them might say "I cannot tell what you are going to do with me," and it was quite idle for the engineer to come and say "We will put you in a much better position than you are in at present—we will give you a dock or a lagoon into which your barges can creep through our arches like a mouse into its hole." But a man might say, "I do not wish to do it, and you cannot make me; I have got a property of £2000 a-year, and I have an easement on the river, and you cannot compel me to give that up by coming to me and saying we want to put you in a better position than you are at present." In questions of this kind the parties generally went before a jury, who decided how the property should be bought and sold, but practical men well knew that juries always returned their verdicts in favour of their neighbours. For himself he could not see his way through any of the schemes proposed. He did not see the necessity of a railway, but he did see the necessity of a good street and promenade on the edge of the river. He wanted to see a plain elevation, showing clearly the present levels of all the buildings and where a road might run without injury to the public. Let them for a moment consider the difficulties of any scheme which a railway must encounter. Starting from Westminster Bridge, on the Middlesex side, they would first have to deal with the

mansion of the Duke of Buccleuch, which was now in the course of erection, at a cost of from £60,000 to £80,000, and who would hardly tolerate a railway under his windows. They would next have to deal with the mansion of Sir Robert Peel, and then they would come to some wharf property, which might be more easily dealt with; but, as they went on, they would have to encounter Somerset House, and the Inner and Middle Temples. Upon the whole there never was a scheme of public improvement surrounded by so many peculiar difficulties, but, no doubt, money and talent would do it. He did not look upon the Thames embankment as an engineering question, it was quite as much the work of an architect, and he might say, without affectation or vanity, that he had himself made many embankments on the Thames in iron, stone, and brick. He had never shrunk, as an architect, from any work of this kind on either side of the river, whether with a coffer dam, or half a coffer dam, or without a coffer dam, and he hoped that every gentleman in the room would feel that he could undertake such a work, and had a right to do so without being an engineer. This was a great economical question, and he thought that men like his friends Mr. Hardwick and Mr. Bunning, and he might venture to add himself, could overcome the difficulty. He thought that they might possibly obtain from the House of Commons the grant of at least a portion of the coal dues, which at present amounted to £60,000 or £70,000 a-year. The discussion had been very useful, but he must invite the architects of England to try their hands upon the subject, because he thought they were more likely to succeed than the engineers.

Mr. Newton, Fellow, observed that, so far as he knew, there never had been the slightest idea that the proprietors of river-side property had a right to build out to Walker's line. Neither Walker's nor Page's lines were taken through the shallow water, and they, perhaps, had their reasons for not carrying it in that direction.

The President said that he did not mean to suggest that any wharfinger had a right to do as he pleased with the bank of the Thames. Hibernia wharf, which belongs to Mr. Alderman Humphrey, had been at one time purchased by the South-Western Railway Company, who had power, by an act of parliament, to make their terminus on that side, but there was an arrangement which affected the laying out of the frontage to the river, and the city, being the conservators of the river, had a right to decide that point. The line of embankment laid down there was rather zig-zag, and Mr. Alderman Humphrey was told that he could embank up to that line, which was the continuation of Walker and Page's lines. So far as he knew that was the history of the Thames embankment, and any one, by paying a certain sum of money, might embank to the extent of Walker and Page's lines. This was the system which had regulated all the embankments, executed hitherto from Mr. Thomas Cubitt's at Pimlico down to the Isle of Dogs, namely, Walker's line regulated by Page's.

Mr. Jennings, Fellow, thought the question of the river navigation had not been properly considered in connection with this question; the mooring of vessels in the stream was considerably affected by the question of tides, and Mr. Walker had himself told him that his line was drawn up purposely with a view to the effect of the tides. Of late years the coal trade had had almost the exclusive possession of the river; in the lower part they lay out and avoided the expense of going into the docks. Above bridge the barges went up on the banks, and the coal owners would say that the Thames embankment, as now before the meeting, would not answer their purpose, therefore the whole of that trade would be interfered with, if not destroyed, by the proposed embankment, and also the whole delivery of sea-borne coal along the banks of the river, would also have to be discharged lower down in the pool, and sent to the various parts of the metropolis by means which must very much impede the general traffic. What he thought was there ought to be a railway by which coals could be delivered into London without interfering with street traffic. He thought the proposed lagoons would be sure to be choked with the alluvial deposit, which he had no doubt proceeded from the rising tide, and the only way to rectify that, it appeared to him, would be to leave them open, and wash them by means of a temporary dam, as was done in some of the Belgian harbours.—Adjourned.

APPENDIX.

ARCHITECTURAL EXAMINATION.

Special General Meeting, January 14th, 1861.

The Chairman (Mr. M. Digby Wyatt, V.P.) read the Notice convening the Meeting, and the Hon. Sec., Mr. T. H. Lewis, then read the Minutes of the last Special General Meeting.

The Chairman announced that the Council had communicated with various Provincial Architectural Societies; viz. the Birmingham, Liverpool, Edinburgh, Glasgow, and Northern Societies, and the Architectural Association, London.

The Hon. Secretary read the replies which had been received.

Mr. J. W. Papworth, Fellow, wished the Meeting to observe that all the replies assumed that the propositions printed and circulated were sanctioned by the whole body of the Institute. This was not the case, nor was it so stated in the circular issued by the Honorary Secretaries.

The Chairman said that the replies had been carefully considered by the Council, who felt that the only decided opinion expressed in them was, "that it was desirable to afford an opportunity for a voluntary professional examination." They did not now intend to draw attention to the separate propositions in the replies, but only to the broad aspect of the question. On the 25th June, 1860, the Institute, after much consideration and discussion, had come to the above conclusion. The proceedings would now, therefore, commence *de novo*, on the basis of the simple fact that the above resolution had been carried unanimously. In accordance with this proposition the Council were not now prepared to bring forward any scheme which might be entertained by the meeting, but they had preferred limiting their present deliberations to a point which they had expressed in a resolution, which it was incumbent on him to move as follows—"That the examination be open to all members of the profession, and that candidates not members of the R. I. B. A. do produce a recommendation, signed by three members of this Institute (one to be a Fellow) and subscribe the declaration as to practice which is signed by members of this Institute."

Mr. Godwin, V.P., seconded the motion, which he considered at all events carried the question one step further. He fully concurred in the resolution that the examination should be voluntary. He was not one of those who would close the profession to all who had not obtained a diploma. He had looked into the foreign systems of compulsory examination, and did not think they had been favourable to art. Neither George Stephenson nor Michael Angelo would have succeeded in producing their great works if they had been compelled to submit to an examination. But he had a strong opinion that the system of pupilage in England should be altered. He himself was frequently asked by young students what course of study they should take and what they were to strive for; and, if voluntary examinations were established, and if the Council would shadow out a course of study and reading, and suggest what course of learning their students should go through, they would do good to architecture, and would also materially benefit the public. There was no desire by the step now proposed to force people into the Institute. The resolution proposed was only a response to a general demand, and in the case of a man coming there and paying the fees which must be paid to obtain the services of proper men for the duty, he would be examined, and if found competent in the various branches of knowledge prescribed he would obtain a certificate that he was so. He viewed the matter as a great educational question, and wholly without regard to any forced diploma, and, on that ground, warmly supported the proposition.

Mr. J. W. Papworth thought the resolution should be preceded by a statement that the Council had done the best they could to obtain the opinion of the profession generally: it should then specify the bodies which had replied to the circular, and then state that the Institute would proceed to take upon itself the responsibility of the examination. At present the resolution already passed merely affirmed that the examination was desirable; and the resolution before the meeting proposed that it should be open to all the profession, but the Council had not yet taken upon themselves the responsibility of the examination. Mr. Papworth proceeded to advert to the importance of connecting art with architecture by means of the examination. A good deal of difference of feeling might be avoided if the Council would lay their own proposition in detail before members, and name some day before Easter for voting on it.

The Chairman said that it was competent to the meeting to postpone the discussion to any time they thought proper, but they should bear in mind that last year the subject had been most carefully considered and digested by the Council, and by experienced professional men whom they had called to their assistance; the architectural press had, since then, discussed the question with great ability, and it had moreover been fully canvassed by the Architectural Association, whose proceedings were of a very suggestive character. He did not therefore consider an adjournment necessary, and thought that whatever steps were taken should emanate from the Institute with as little delay as possible. He was prepared to receive for discussion any amendment on the resolution proposed by him in the name of the Council.

A Member observed that the original circular had been sent out in July last, and the Council had therefore been a considerable time in coming to this resolution.

The Chairman explained that the delay had been necessary, in order to receive the replies from the various societies. The Architectural Association had not communicated its decision until the 21st of December.

Mr. C. Mayhew, Fellow, said the original proposition had been very much altered. It was at first proposed that "the examination should be applicable to the associates and future fellows of the Institute."

The Chairman said that the words quoted had not been passed as a resolution.

Mr. C. Mayhew wished to know whether Members would pass under the resolution now proposed. All the Associations were applied to for their opinions on that subject, but it was now proposed to have quite a different examination, so that any person, whether a Member of the Institute or not, might pass.

Mr. Jennings, Fellow, said the question was whether the Examination should be open. His own opinion had been that it was desirable to require that all persons intending to offer themselves for Examination should enter themselves as students of the Institute, and that by doing so, and paying the fees, they should be entitled to an Examination. He thought this particularly desirable, because a temporary connexion would partly tend to a permanent connexion with the Institute. The question for the Meeting to determine was whether the examinations should be thrown open to all, or whether the candidates should be required to become students of the Institute.

Mr. J. W. Papworth said that when it was resolved to afford an opportunity for a Voluntary Examination, it had not been resolved that the Institute should take that examination upon themselves; neither was anything resolved as to the mode of examination. The meeting ought, therefore, to pass a resolution to that effect, before further considering the details.

The Chairman, Mr. Godwin, and Mr. Penrose explained the terms of the resolution as proposed by the Council.

Mr. G. E. Street, Fellow, inquired whether the Institute had not already established an examination for the Election of District Surveyors.

The Chairman stated that they had done so, but that in that case the candidates were obliged to declare that they applied to be examined with a view to prove their competency only to perform the functions required in a District Surveyorship. The words of the Council's resolution implied that the examination, now proposed, should be open to all Members of the Profession, and that candidates, not Members of the Institute, should sign a declaration to practice as Architects according to the rules of the Institute, as a condition precedent to their admission to any such examination.

Mr. J. W. Papworth moved—"That this Institute by the publication of the resolution of the 25th June, 1860, and by the circulation of the propositions submitted by the Council at that time, having, to the utmost of its power, ascertained the views of the profession thereon, and having taken into consideration the replies forwarded by the various societies, does, in conformity with the wishes expressed in these communications, take upon itself the labour of constituting an Examination tending to promote a systematic professional education."

Mr. Kerr, Fellow, seconded the motion, presuming that it did not interfere with the Resolution of the Council.

The Chairman suggested that there could be no objection whatever to Mr. Papworth's motion, and the only question was whether it should be put as an amendment on the motion put forward by the Council, or whether the latter should be withdrawn for a time.

Mr. Penrose, Hon. Sec. F.C., did not consider Mr. Papworth's motion an amendment.

It was then agreed that the motion proposed by the Council should be withdrawn for the present, and the resolution proposed by Mr. Papworth, and seconded by Mr. Kerr, was put and carried.

The Chairman said that the original motion proposed on behalf of the Council would now be put as follows:—"That the Examinations be open, &c., &c."

This had already been proposed by himself, and seconded by Mr. Godwin.

An inquiry was made by Mr. Boulnois, Fellow, as to what was meant by "Members of the Profession:"—an important question as affecting those who assumed the title of Architects without authority, but who might get the signatures of two respectable Architects or Surveyors, in order to entitle them to examination.

The Chairman said that the Council had relied, to a certain extent, in guarding against such abuse on the necessity of procuring the recommendation by Members of the Institute. The examination itself must settle the value of the individual ability of the Candidate.

Mr. Kerr said the question now raised must be considered, in the present early stage of the matter, as entirely one of detail. The principle of a recommendation appeared to be settled, but not the extent to which the recommendation should go. At present the recommendations for a Member of the Institute went to show that the parties were fit and proper persons for Election under the Charter and Bye-Laws, but that would not be so under the new plan.

The Chairman said that it would be unwise to express any opinion (unless it were on a general principle or some general sets of principles) to tie the hands of those who were to conduct the Examination. The Council did not, therefore, now propose to bring in any distinct affirmation on those or any other such details.

Mr. Kerr suggested that it might be better to leave the recommendation less limited.

At the request of Mr. JENNINGS, the CHAIRMAN read the following form of declaration now signed by Associates, it being proposed, of course, so to modify it as to make it apply to the case of candidates not members of the Institute:—

I, the undersigned, being elected an Associate of the Institute of British Architects, do hereby declare that I am engaged in the study of Civil Architecture, and have attained the age of twenty-one years; that I will not receive or accept of any pecuniary consideration or emolument from any builder or other tradesman, whose works I may be engaged to superintend;—and that I will not have any interest or participation in any trade contract or materials, supplied at any works, the execution of which I may be engaged to superintend;—and I further promise and engage, that I will be governed by the Charter of Incorporation and by the Bye Laws of the said Institute, or as they may be hereafter altered, amended, or enlarged; and that by every lawful means in my power I will advance the objects of the said Institute, and will attend the meetings thereof, as often as I conveniently can; provided that whenever I shall signify in writing to one of the Secretaries for the time being, I am desirous of withdrawing my name therefrom, I shall (after payment of any arrears which may be due at that period) be free from this obligation.

The CHAIRMAN further explained the intended declaration, and the rules of practice adopted by the Institute.

Mr. JENNINGS said that the declaration would not prevent the candidate being a builder.

Mr. HAYWARD, Associate, said he had attended under the idea that the discussion was to be confined to the examination of members of architectural bodies, which he thought would include other societies than their own; but now a very different affair was to be entered on. To him it appeared likely that if every one could come here and pass such an examination, and receive a ticket of proficiency, it would be entirely prejudicial to the interests of the members of the Institute and the profession, because any person coming and signing a declaration and getting a certificate, might afterwards do anything contrary to the right practice of the profession. This they had not guarded against, but had merely been discussing modes of proceeding. The only question was, whether persons taking these certificates or diplomas would not thereby secure a position which they could not hope for at present. The object was to provide a better and more solid education for students, instead of a discursive education, such as there was now. Then as to a compulsory examination. There were many members present whom it would be absurd to ask to pass an examination; but after a certain time it would become a compulsory examination for all. It had to be settled whether they were ultimately tending to a diploma or not. All these points required thorough ventilation. His idea was, that after due notice, say two years hence, all candidates for admission to the Institute or other like professional societies elsewhere, should pass an examination and receive a certificate, which would ultimately have the effect of a diploma, if the examinations were carried out so as to secure the respect of the members of the profession generally.

Mr. C. MAYHEW thought the examination should be for future Associates and Fellows, and that it should not be commenced till some time after the 1st of January, 1862, in order that the candidates should have time to qualify themselves. The present Fellows should receive the certificate forthwith, as well as architects who had been seven years in practice, or had erected some building which the Council approved of, as a qualification. A curriculum of examination, if approved of by the general body before the 1st of June, would do away with a great deal of acrimony and schism. He thought it would be better to adjourn the question, and appoint a Committee to consider the views that had been expressed. The resolution now proposed would in his opinion be injurious.

Mr. KERR thought it would be best to refer the matter back to the Council or a Committee, and if it were again brought forward as a perfect working scheme, there would be very little objection to it. But it was desirable to settle the broad question that the examination should be as little restricted as possible.

Mr. JENNINGS thought it would be unwise to limit the examination to Members of the Institute. It ought to be thrown open to the public under some restrictions He would move, as an amendment, "That the Examination be open to any British subject, making such declaration of his intention to follow the profession of Civil Architecture, as may be determined by the Council, and producing the recommendation of three Members of the Institute, one being a Fellow." The objection that persons obtaining certificates might act contrary to the rules of the profession was of little importance, and was never taken into consideration by the Medical Colleges,—many of whose members turned out badly after obtaining their diplomas.

Mr. J. W. PAPWORTH said it was equally disregarded in examinations for the Civil Service. He would second Mr. Jennings's amendment, first, because it was impossible to confine the examination to their own members; secondly, because they had a right to demand a declaration that the candidate positively intended to become an architect; and thirdly, because he believed if the candidates must have a recommendation from three Members of the Institute, they would get up preliminary examinations of their own, and very few candidates would be plucked He held that they would have no right to exclude a builder's clerk, if he applied to be examined.

The CHAIRMAN said he thought that there would be no reluctance on the part of the Council to adopt the alterations proposed.

Mr. GODWIN considered that course preferable to an amendment.

Mr. STREET objected to the scheme of an examination, because he feared that the result of it would be the severance of art and practice, whilst its main object seemed to be the closing of the profession to all who did not hold some kind of diploma or certificate. He concurred in thinking that any examination must be thrown open to all, though the results of this might not be agreeable to its promotors: *e. g.* a builder might come up for examination, obtain his certificate, and go away with authority to call himself an architect as well as a builder, though he knew nothing whatever about art. For his own part, he should rejoice to see painters and sculptors working as architects also; he protested against any step which might prevent this, and he thought a forced examination might do so. Inigo Jones, Wren, Vanbrugh, Kent, Gibbs, and Chambers were not bred as architects, and began their work at about thirty-five years of age—just the time of life when they would probably have refused to pass any kind of examination. The resolution to which his assent was asked appeared to aim at the establishment of an academical system of architectural study, and he believed that it would not at all help forward the cause of art, and that the best men would ignore the whole scheme, and practice in defiance of it.

The CHAIRMAN reminded Mr. Street that the Institute had affirmed unanimously that it was desirable to afford facilities for a "voluntary" examination.

Mr. GRAY, Fellow, hoped to see the Institute in the same position with regard to the profession as the Law Institution held with regard to the Law. If a lawyer turned out a scamp, the Law Institution turned him out, and the Institute might do the same. The Institute should be dealt with not as a private society, but as representing the profession, and ultimately the examination should be compulsory on all.

Mr. LEWIS, Hon. Sec. said, that if a candidate obtained a certificate, and afterwards acted

contrary to the rules of the profession, the Council, on its being represented to them, might give him proper notice, and on his still continuing so to act might publicly withdraw his certificate.

Mr. Hayward thought that a certificate once granted could hardly be withdrawn. The thing should be done thoroughly, or not at all. He was of opinion that the examination should be limited to members of the profession; and, it being a purely professional question, he objected entirely to its being thrown open to builders or the public generally.

Mr. Morris, Associate, observed that the Institute would act unjustly to the profession if it were to grant certificates to tradesmen.

Mr. T. Roger Smith, Associate, called the meeting back to the educational question, as enunciated by Mr. Godwin. Any restriction on the admission of candidates for examination would be disadvantageous in that respect. It might be advantageous that the candidates should be examined on the contents of certain books, and should be required to show their acquaintance with those books, as the necessity of, in this manner preparing for an examination, would induce pupils and young men to apply themselves to real study at a time when they ordinarily have leisure and opportunities, which, under the present system, are but rarely made use of. Having opportunities of knowing the feelings of many of the younger members of the profession, and having attended carefully to the expressions of opinion elicited from them during the discussion of the subject at the Architectural Association, he felt justified in stating that the need of some such incentive was felt by young men, and that an examination having this aim would be heartily and universally welcomed, but that a great divergence of opinion existed as to anything approaching more closely to a test examination and a diploma. He personally thought it would be advantageous, rather than not, if others, besides architects, were to come forward and undergo such an examination; and he trusted that the broadest and most liberal view possible would be taken of the question, convinced that such a view would conduce the most thoroughly to the advantage of the profession, and that whatever was for the advantage of the profession at large could not fail equally to be of advantage to this Institute.

Mr. Burges, Fellow, said that in the sketch of the subjects for examination which had been printed and circulated, there was no provision made for drawing the figure. He thought that the real fact was that principals had not done their duty to their pupils,—and this involved the question of premiums, because 300*l.* might be too much for a bad teacher, and too little for a good one.

The Chairman said the sketch referred to had not been adopted, and could not, now, form a subject for discussion.

Mr. Jennings, in calling attention to the resolutions immediately before the meeting, pointed out that the object at present was to make the two resolutions coincide without the necessity of an amendment.

The Chairman was about to put the altered resolution, when

Mr. Hayward moved an adjournment of the discussion, and said that he stood upon his right to do so in behalf of absent members, although only an associate.

Mr. G. E. Street seconded the amendment.

The Chairman thought it would not be desirable to adjourn. The two propositions were very nearly in consonance, and the Council did not object to either.

The motion of adjournment was put and negâtived.

Mr. G. E. Street then moved as an amendment, that the words "British subject" be altered to "any person."

Mr. Robinson, Fellow, seconded the amendment, which was put to the vote and negatived.

The resolution, as slightly altered, and agreed to by the Council, was put to the vote and carried, as follows:—

"That the examination be open to any British subject; and that candidates, not members of the Royal Institute of British Architects, do produce a recommendation, signed by three members of the Institute (one of them being a Fellow), and subscribe a declaration of their intention to practise, as architects, in accordance with the usual rules of the Institute."

The CHAIRMAN said that the Council had agreed that, in the event of any such resolution as the one he had had the honour to propose being carried, it would be expedient for them to put the examination into operation as soon as possible. To enable them to do this it was necessary that they should have distinct freedom of action, and they had, therefore, instructed him to propose from the chair, "That the Council be empowered to carry the said resolution into execution."

Mr. PENROSE seconded the motion.

Mr. KERR moved as an amendment "That the Council be instructed to proceed with the preparation of a curriculum and bye-laws, and be recommended to appoint a committee to this end, and to report to a general meeting."

Mr. BURGES seconded the amendment.

The CHAIRMAN said the Council would naturally appoint a committee to work out the plan. Even if the Council were willing to do so, they could not, by themselves carry it out, and he did not think the general body of members could do so satisfactorily. The Council wished for power to appoint a committee and to proceed to action without recurring again to the body at large.

Mr. PAPWORTH presumed the Committee in that case would consist of Members of the Council.

The CHAIRMAN said there was nothing to prevent its being so constituted, but he found that the majority of the Members of the Committees recently appointed were not on the Council.

Mr. PAPWORTH thought the Committee should comprise "Members of the Council and others." He inquired whether the Council would be bound to adopt the Report of the Committee.

The CHAIRMAN said the curriculum to be adopted might be submitted to the Members.

Mr. NEWTON, Fellow, proposed that the Committee should sit once a fortnight and report to the Council.

The CHAIRMAN thought it was not expedient that any details of the scheme should be laid before the Members until the whole scheme had been prepared. The Members might either give the Council an outline upon which the Committee could act, or they might (which he thought the better course) give the Council power to go on and try an experiment, which might hereafter be modified without any difficulty or unenviable notoriety. This would be better than having a cut and dried scheme, to which the whole body of the Institute might stand pledged, and which it would be very troublesome, without scandal, to change or afterwards cut to pieces. The Council, however, were in the hands of the Members who might themselves appoint the Committee.

Mr. BURGES suggested that the curriculum adopted should be circulated among the Members a fortnight before the meeting at which it was proposed to be confirmed.

After some conversation,

The CHAIRMAN said the Council were willing, if such were the inclination of the meeting, to accept Mr. Kerr's motion instead of that proposed by them.

Mr. KERR's motion was accordingly put and carried unanimously.

The thanks of the Meeting were voted to the Chairman and the proceedings terminated.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Incorporated in the Seventh Year of William IV.

PATRONESS . . HER MOST GRACIOUS MAJESTY THE QUEEN.

PATRON . . . H. R. H. THE PRINCE CONSORT.

LIST OF THE MEMBERS;

THE REPORT OF THE COUNCIL,

READ AT THE ANNUAL GENERAL MEETING HELD 6TH MAY, 1861,

WITH

THE BALANCE SHEET,

AND

LIST OF CONTRIBUTIONS TO THE COLLECTION AND LIBRARY.

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1861.

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(Corrected to 11th June, 1861.)

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ELECTED. ASSOCIATE.	FELLOW.		
1851	1860		Charles Ainslie, 10, Old Jewry Chambers.
	1840		*George Alexander, F.S.A., Westrop House, Highworth, Wilts.
	1859		T. G. D. Allason, 1, Connaught Square, Hyde Park.
1835	1860		Thomas Allom, Barnes, Surrey.
	1834	(D)	†*Samuel Angell, Abbey Lodge, Chertsey.
	1861		Edward Appleton, Torquay.
	1851		*Arthur Ashpitel, F.S.A., 2, Poet's Corner, Westminster.
	1844		†*Henry Ashton, 5, Victoria Street, Westminster.
	1851		Henry G. Austin, Canterbury.
	1855		*Henry Baker, 11, Upper Gower Street.
	1842		William Barnes, 3, Church Court, Old Jewry.
1846	1854		*Charles Barry, 27, Sackville Street, Piccadilly.
1855	1860		*Edward M. Barry, A.R.A., 1, Old Palace Yard, Westminster.
	1856		John Belcher, 5, Adelaide Place, London Bridge.
1840	1850		*James Bell, 1, Devonshire Place, Portland Place.
	1851		Richard Bell, 17, Gracechurch Street.
	1834	(D)	†*Thomas Bellamy, 8, Charlotte Street, Bedford Square.
	1856		John Billing, 12, Abingdon Street, Westminster.
	1859		E. C. S. Blake, 42, Parliament Street.
	1857		Gilbert R. Blount, 1, Montagu Place, Montagu Square.
	1835	(D)	*W. J. Booth, Lisworney, Torquay.
1848	1859		W. A. Boulnois, 6A, Waterloo Place, Regent Street.
1839	1840	(D)	*David Brandon, F.S.A., 24, Berkeley Square.
	1860		Raphael Brandon, 17, Clement's Inn, Strand.
	1860		Cuthbert Brodrick, Leeds.
	1845		David Bryce, Edinburgh.
	1849		†*J. B. Bunning, F.S.A., 6, Gloucester Terrace, Regent's Park.
	1860		William Burges, 15, Buckingham Street, Strand.
	1835	(D)	*William Burn, 6, Stratton Street.
	1845		John Burrell, 144, New Bond Street.
	1834	(D)	†Decimus Burton, F.R.S., F.S.A., 6, Spring Gardens.
1839	1843		*T. Talbot Bury, 50, Welbeck Street.
1842	1860		Louis George Butcher, 102, Guildford Street, Russell Square.
	1861		John H. Chamberlain, Birmingham.
	1836		*Robert Dennis Chantrell, 7, Park Place, Camberwell Grove.
1840	1850		*Ewan Christian, 10, Whitehall Place.
1845	1859		G. Somers Clarke, 20, Cockspur Street.
1841	1853		*Joseph Clarke, F.S.A., 13, Stratford Place, Oxford Street.
1842	1857	(D)	J. Clayton, King Street, Hereford.
1838	1850		*Henry Clutton, 9, Whitehall Place.

ELECTED. ASSOCIATE.	FELLOW.		
	1854		*Henry Clutton, 9, New Burlington Street.
	1857		Daniel Addington Cobbett, 57, Fenchurch Street, City.
	1849	(d)	†C. R. Cockerell, r.a., Foreign Member of the Institute of France, and of other Societies; 13, Chester Terrace, Regent's Park; Past President r.i.b.a.
1841	1848		*John J. Cole, 24, Essex Street, Strand.
1856	1860		James K. Colling, 6, Ridgmount Place, Hampstead Road.
	1858		J. Colson, Winchester.
	1845		C. N. Cumberlege, 5, John Street, Adelphi.
	1835	(d)	*Thomas Cundy, 13, Chester Square, Pimlico.
	1857		Thomas Cundy, Jun., 12, Eccleston Square, Pimlico.
1848	1856		*Henry Currey, 4, Lancaster Place, Strand.
	1860		H. Dangerfield, Cheltenham.
	1856		Henry A. Darbishire, 4, Trafalgar Square.
	1835		*John Davies, Grove Hill, Woodford, Essex.
	1856		George Devey, 16, Great Marlborough Street.
	1845		John Dobson, Newcastle-upon-Tyne.
	1834	(d)	†*Thomas Leverton Donaldson, Professor of Architecture at University College, London; Bolton Gardens, Russell Square.
1856	1859		James Edmeston, 5, Crown Court, Old Broad Street, City.
1857	1861		Francis Edwards, 17, Hart Street, Bloomsbury.
	1854		George Elkington, 19, Cannon Street West, City.
1849	1859	(d)	*James Fergusson, 20, Langham Place.
	1839		†*Benjamin Ferrey, 1, Trinity Place, Charing Cross.
	1834	(d)	†*Charles Fowler, Totridge House, High Wycombe, Bucks.
	1835	(d)	*Edward M. Foxhall, 18, South Audley Street.
1841	1857		*F. J. Francis, 38, Upper Bedford Place, Russell Square.
	1845		Charles Freeman, 58, Lincoln's Inn Fields.
	1838		Thomas Fulljames, Barton Street, Gloucester.
1857	1861		Joseph Gale, 150, Bermondsey Street.
	1848	(d)	*Henry Garling, 27, Bedford Row.
1843	1857		H. B. Garling, 11, King's Road, Bedford Row.
1849	1853		*John Gibson, 13, Great Queen Street, Westminster.
	1854		Alfred Gilbert, South Bank, Grotto Buildings, Blackheath.
	1860		Charles E. Giles, 24, Westbourne Park Road.
	1854		J. E. Gill, 1, Fountain Buildings, Bath.
1836	1841	(d)	†*George Godwin, f.r.s., f.s.a., 24, Alexander Square, Brompton.
	1860		Sidney Godwin, 24, Alexander Square, Brompton.
1840	1847	(d)	*J. H. Good, 75, Hatton Garden.
	1836	(d)	H. E. Goodridge, Bath.
	1860		Charles Gray, 22, Westbourne Place, Eaton Square.
	1842		John Griffith, 16, Finsbury Place South.
	1847		W. P. Griffith, 16, Guildford Street, Russell Square.
	1835	(d)	*George Gutch, Porteus House, Porteus Road, Paddington.
1852	1860		Edward Habershon, 37, Bedford Place, Russell Square.
	1852		W. G. Habershon, 38, Bloomsbury Square.
1835	1847		Matthew Ellison Hadfield, Knowl House, Sheffield.

ELECTED. ASSOCIATE.	FELLOW.		
	1842		*J. H. Hakewill, 50, Maddox Street, Bond Street.
1838	1854		*E. C. Hakewill, 5, South Molton Street.
1848	1860		Octavius Hansard, 11, Argyll Place, Regent Street.
	1834	(D)	†Philip Hardwick, R.A. F.R.S., F.S.A, 21, Cavendish Square.
	1850		*Philip Charles Hardwick, F.S.A., 21, Cavendish Square.
	1850		William Rooke Harrison, Courbevoie, près Paris.
1855	1861		Charles Forster Hayward, 8, Adam Street, Adelphi.
	1857		*William Haywood, Guildhall, City.
1838	1860		Charles Henman, 7, Millman Street, Bedford Row.
	1849		*Robert Hesketh, 7, Royal Exchange, City.
1854	1861		J. H. Hirst, Bristol.
1835	1847	(D)	J. D. Hopkins, 25, Bedford Square.
1848	1861		C. H. Howell, Norwich Union Office, 3, New Bridge St. Blackfriars.
1856	1859		A. J. Humbert, 27, Fitzroy Square.
	1852		†*R. C. Hussey, F.S.A., 16, King William Street, Strand.
	1840		*Edward I'Anson, 7A, Lawrence Pountney Hill.
	1835		†*W. S. Inman, Frome Selwood, Somersetshire.
	1858		Thomas Jeckel, 10, Buckingham Street, Adelphi; and Norwich.
	1847		*Joseph Jennings, 11, Langham Street.
1842	1858		Horace Jones, 16, Furnival's Inn.
	1843	(D)	*Owen Jones, 9, Argyll Place, Regent Street.
	1834	(D)	†*H. E. Kendall, 1, Spring Gardens.
1835	1842		*H. E. Kendall, Jun., 33, Brunswick Square.
	1857		*Robert Kerr, 17, Bedford Place, Russell Square.
1856	1860		T. E. Knightley, 25, Cannon Street, City.
	1861		John G. Knight, Melbourne, Victoria, Australia.
	1847		*James Thomas Knowles, 1, Raymond Buildings, Gray's Inn.
	1837		E. B. Lamb, 3, Hinde Street, Manchester Square.
	1842		*G. O. Leicester, 5, Bishop's Road, Bayswater.
1845	1860		Frederick Lett, 36, Essex Street, Strand.
1845	1852		*T. Hayter Lewis, 9, John Street, Adelphi.
	1836		William Conrad Lochner, 5, West Street, Finsbury Circus.
1848	1859	(D)	J. M. Lockyer, 19, Southampton Street, Fitzroy Square.
1856	1860		George Low, 10, Basinghall Street, City.
	1842		*George J. J. Mair, F.S.A., 41, Upper Bedford Place, Russell Square.
	1856		S. S. Markham, Cornwall Cottage, Cornwall Road, Brixton Hill.
	1856		*Frederick Marrable, 17, Marlborough Place, St. John's Wood
1851	1860		E. H. Martineau, 24, Lincoln's Inn Fields.
	1846		*Charles Mayhew, 14, Argyll Street, Regent Street.
	1859		George W. Mayhew, 14, Argyll Street, Regent Street.
	1836	(D)	†* David Mocatta, F.S.A., 29, Gloucester Square, Hyde Park.
1850	1856		*George Morgan, 2, Dane's Inn, Strand.
1838	1850		*Andrew Moseley, Trinity Chambers, Charing Cross.
	1860		James Murray, Coventry,
	1834		*William C. Mylne, F.R.S., New River Head.
1839	1849		*R. W. Mylne, F.R.S., 21, Whitehall Place.
1845	1859		Edwin Nash, 5, Adelaide Place, London Bridge.

ELECTED. ASSOCIATE.	ELECTED. FELLOW.		
	1843	(D)	*Charles C. Nelson, 30, Hyde Park Gardens.
	1860		A. S. Newman, 185, Tooley Street, Southwark.
1853	1860		H. R. Newton, 6, Argyll Street.
	1861		Thomas Nicholson, Hereford.
	1835	(D)	*James Noble, Battersea House, West Battersea.
1850	1857		*John Norton, 24, Old Bond Street.
1841	1846	(D)	*J. W. Papworth, 14a, Great Marlborough Street.
	1860		Wyatt Papworth, 14a, Great Marlborough Street.
	1834	(D)	*Charles Parker, 75, Great Russell Street.
	1860		Robert Parris, Wolsingham Place, Lambeth.
	1861		Henry Parsons, Gresham House Chambers, Old Broad Street, City.
	1859		E. J. Payne, Bennett's Hill, Birmingham.
1850	1859		Joseph Peacock, 15, Bloomsbury Square.
	1860		John L. Pearson, f.s.a., 22, Harley Street.
	1840		*James Pennethorne, 7, Whitehall Yard.
1846	1848		†*F. C. Penrose, m.a., Cathedral Surveyor's Office, Chapter House, St. Paul's Church Yard.
1849	1861		R. Kyrke Penson, Ferryside, Kidwelly.
1850	1859		R. M. Phipson, Ipswich.
1837	1846		*William W. Pocock, 35, Craven Street, Strand.
1856	1860		Alfred Porter, 2, Fir Grove Place, Brixton.
1850	1855		*Frederick W. Porter, 16, Russell Square.
1857	1860		Frederick H. Pownall, 15, Gower Street, Bedford Square.
1840	1843	(D)	*George Pownall, 60, Lincoln's Inn Fields.
1861	1861		G. E. Pritchett, 4, Great St. Helens, Bishopsgate.
	1861		Richard P. Pullan, Wimborne, Dorset.
1848	1860		C. F. Reeks, 12, Middle Scotland Yard.
	1838	(D)	C. J. Richardson, 34, Kensington Square.
	1860		Edward Roberts, 25, Parliament Street.
	1837	(D)	*Henry Roberts, f.s.a., 31, Princes Square, Kensington Gardens.
1853	1860		Edward C. Robins, 19, Arundel Street, Strand.
	1860		G. T. Robinson, 14, Milverton Crescent, Leamington.
	1845		*Robert L. Roumieu, 10, Lancaster Place, Strand.
1854	1856	(D)	R. R. Rowe, 10, Emmanuel Street, Cambridge.
1851	1860		Edward Salomons, 63, King Street, Manchester.
	1836	(D)	†*Anthony Salvin, f.s.a., 11, Hanover Terrace, Regent's Park.
1850	1861		Anthony Salvin, Jun., 4, Adam Street, Adelphi.
	1835	(D)	†*J. J. Scoles, 58, Pall Mall.
	1849		†*George Gilbert Scott, r.a., 20, Spring Gardens.
1852	1860		J. P. Seddon, 6, Whitehall.
	1848	(D)	Edmund Sharpe, Coed-y-celyn, Llanrwst, Carnarvonshire.
	1836	(D)	*John Shaw, Christ's Hospital, City.
	1860		Robert H. Shout, 1, Duchess Street, Portland Place.
1849	1861	(D)	R. L. Sibley, 39, Great Ormond Street.
1855	1859		*William Slater, Carlton Chambers, 4, Regent Street.
	1844	(D)	†*Sydney Smirke, r.a., f.s.a., Professor of Architecture at the Royal Academy, 79, Grosvenor Street.
	1834	(D)	†George Smith, 4½, Frederick's Place, Old Jewry.

ELECTED. ASSOCIATE.	FELLOW.		
	1842		Thomas Smith, 36, Hart Street, Bloomsbury Square.
	1856		William James Smith, Leghorn.
1837	1856	(d)	*James P. St. Aubyn, 35, John Street, Bedford Row.
	1850		*I. H. Stevens, 22, Sackville Street, Piccadilly.
	1858		N. E. Stevens, Brewer Street, Maidstone, Kent.
	1857		Coutts Stone, 16, Great Marlborough Street.
1850	1861		Lewis Stride, 5, Bloomsbury Square.
	1859		*George Edmund Street, f.s.a., 33, Montague Place, Russell Square.
	1845		John Tarring, 23, Charles Street, Middlesex Hospital.
	1835		John H. Taylor, 22, Parliament Street.
1835	1842		*Samuel Sanders Teulon, 2, Lansdown Place, Brunswick Square.
1854	1860		W. Milford Teulon, 42, Guildford Street, Russell Square.
	1835		*James Thomson, 57, Devonshire Street, Portland Place.
	1842	(d)	†William Tite, f.r.s., f.s.a., m.p., 42, Lowndes Square; President r.i.b.a.
	1854		Richard Tress, 27, Queen Street, Cheapside.
	1860		George Truefitt, 5, Bloomsbury Square.
1838	1856	(d)	*G. Vulliamy, Office of Works, Spring Gardens.
	1856		F. S. Waller, Gloucester.
1843	1850		W. W. Wardell, Melbourne, Australia.
1845	1860		*J. B. Waring, 14, Southampton Street, Strand.
	1861		Alfred Waterhouse, Manchester.
	1853		J. G. Weightman, Sheffield.
1844	1850		*John Whichcord, 16, Walbrook, City.
	1859		William White, 30a, Wimpole Street.
1854	1857		W. Wigginton, 4, Moscow Terrace, Hackney Wick.
1848	1856		*G. B. Williams, 4½, Frederick's Place, Old Jewry.
	1842		T. Willoughby, 11a, Cunningham Place, St. John's Wood Road.
1841	1847		*Sancton Wood, 10, Craig's Court, Charing Cross.
1839	1846		*Edmund Woodthorpe, 28a, Basinghall Street, City.
1849	1854		†*M. Digby Wyatt, f.s.a., 37, Tavistock Place, Tavistock Square.
	1839		†*Thomas H. Wyatt, 77, Great Russell Street, Bloomsbury Square.

HONORARY FELLOWS.

ELECTED.	
1837	The Most Hon. the Marquis of Salisbury, k.g., Arlington Street.
1837	The Most Hon. the Marquis of Lansdowne, k.g. f.r.s., Berkeley Square.
1860	The Right Hon. the Earl de Grey and Ripon, Carlton Gardens.
1836	Sir Robert Smirke, f.s.a., Cheltenham.
1835	Charles Morrison, Esq., 57, Upper Harley Street.
1841	Beriah Botfield, Esq., m.p., f.r.s., f.s.a., 5, Grosvenor Square.
1850	Henry Thomas Hope, Esq., 116, Piccadilly.
1850	Alexander J. B. Beresford-Hope, Esq., f.s.a., Arklow House, Connaught Place.

HONORARY MEMBERS.

ELECTED.

1835 (D) His Highness the Rajah of Tanjore.
1835 Michael Faraday, Esq., D.C.L. F.R.S., Royal Institution, Albemarle Street.
1835 The Rev. Wm Whewell, D.D. F.R.S., F.S A., Master of Trinity College, Cambridge.
1835 The Rev. R. Willis, M.A. F.R.S., 23, York Terrace, Regent's Park.
1838 (D) Sir Gardner Wilkinson, F.R.S., 33, York Street, Portman Square.
1839 The Rev. Richard Burgess, B.D., 69, Cadogan Place.
1844 (D) James Walker, Esq., F.R.S., 23, Great George Street, Westminster.
1848 Eaton Hodgkinson, Esq. F.R.S., Eaglesfield House, near Manchester.
1850 Austen Henry Layard, Esq. M.P., D.C.L., Athenæum Club.
1852 (D) The Rev. J. L. Petit, M.A., F.S.A., 9, New Square, Lincoln's Inn.
1853 Charles Winston, Esq., 3, Harcourt Buildings, Temple.
1855 Joseph Woods, Esq., F.S.A., Lewes, Sussex.
1855 (D) C. H. Smith, Esq., 24, Hatton Garden.
1857 Henry Shaw, Esq., F.S.A., 37, Southampton Row
1858 George Petrie, Esq., LL.D., Dublin.

HONORARY AND CORRESPONDING MEMBERS.

AUSTRIA.—

1850 Herr Kranner, Architect - *Prague,*
1850 Christian Hansen, Architect - - *Trieste.*
1837 (D) Professor C. F. Ludwig Förster - - *Vienna.*

BELGIUM:—

1837 P. Bourla, Architect, Member of the Academy - *Antwerp.*
1852 J. P. Cluysenaar, Architect } *Brussels.*
1835 Monsieur Suys, Architect to H.M. the King of the Belgians }
1835 Louis Roelandt, City Architect - - *Ghent.*
1850 Monsieur Delsaux, Architect of the Province - *Liège.*
1842 Brunot Renard, Architect - *Tournay.*

DENMARK:—

1835 G. Hetsch, Architect. - - *Copenhagen*

EGYPT:—

1861 Monsieur Mariette - - *Cairo.*

FRANCE:—

1847 Firmin Epellet, Architect of the Department of the Pas de Calais *Arras.*
1850 Monsieur Guy, City Architect } - *Caen.*
1848 Monsieur de Caumont }
1846 (D) Girault de Prangey - - *Dijon.*
1852 F. Brunet-Debaines, Architect - - *Paris.*
1853 Monsieur Benvignat, Architect - - *Lille.*
1842 Pascal Coste - - *Marseilles.*

ELECTED.				
1842	(D) Auguste Caristie	Members of the Institute of France.	Architects	*Paris.*
1840	Felix Duban			
1851	M. P. Gauthier			
1835	(D) J. J. Hittorff			
1835	L. H. Le Bas			
1846	J. B. Lesueur			
1855	Monsieur Gilbert			
1855	Alphonse de Gisors			
1856	(D) Monsieur Viollet Le Duc			
1857	Monsieur Lefuel			
1844	(D) César Daly		Architects -	*Paris.*
1855	Monsieur Armand			
1855	Monsieur Pellechet			
1855	Rohault de Fleury			
1857	Monsieur Didron Aîné			
1850	Monsieur Fries, Architect -		-	*Strasburg.*
1855	Chenavard, Architect -		-	*Lyons.*
1855	Morey, Architect - -		-	*Nantes*
1856	Hippolyte Durand, Architect -		-	*Bayonne.*

GERMANY.—

Baden—

1837	Heinrich Hübsch, Architect -	-	*Carlsruhe.*

Bavaria—

1835	Chevalier Leo von Klenze, Privy Counsellor of H.M. the King of Bavaria	Architects -	*Munich.*
1850	Herr Metzger		
1842	Friedrich Ziebland		

German States—

1838	Professor F. N. Hessemer	Architects	*Frankfort on the Maine.*
1842	Friedrich Peipers		
1848	F. Lange, Architect -	-	*Fulda, Hesse Cassel.*
1848	J. Offermann, Director of the Public Works		*Mayence, Hesse Darmstadt.*
1842	Herr Fischer, Architect -	-	*Saxe Coburg.*

Hanover—

1837	(D) Herr Laves, Architect to H.M. the King of Hanover -	*Hanover.*

Prussia—

1851	Herr Stein, Architect -	-	*Aix la Chapelle.*
1850	Herr Busse, Architect, Director of the Academy of Public Constructions		*Berlin.*
1861	Herr C. R. Lepsius		
1842	August Stüler, Architect to H.M. the King of Prussia		
1842	Heinrich Strack, Architect, Professor of the Royal Academy of Fine Arts		
1850	Herr Wilhelm Zahn		

ELECTED.		
1848	HERR SULPICE BOISSERÉE, Architect -	*Bonn.*
1847	HERR ZWIRNER, Architect - -	*Cologne.*
1857	HERR WIEGMAN, Architect - -	*Düsseldorf.*
	Saxony—	
1850	HERR GEUTEBRÜCK, Architect of the University	*Leipzig.*
	SWITZERLAND:—	
1859	GOTTFRIED SEMPER - -	*Zurich.*
	GREECE:—	
1857	IL SIGNOR LYSANDROS KAFTANGIOGLOU -	*Athens.*
	HOLLAND:—	
1839	MONSIEUR ZOCHER, Architect, Member of the Institute and Royal Academy of Fine Arts at Amsterdam -	*Haarlem.*
1835	L. REIJERS, City Architect - -	*The Hague.*
	ITALY.—	
1849	IL SIGNOR VANTINI, Architect - -	*Brescia.*
1839	IL SIGNOR BESIA, Member and Professor of the Imperial and Royal Academy of the Fine Arts -	*Milan.*
1856	IL SIGNOR GARDELLA - -	*Genoa.*
1850	IL CONTE SELVATICO - -	*Venice.*
1849	IL SIGNOR MIGLIORANZA, Architect -	*Vicenza.*
1847	IL CAVALIERE NICCOLO MATAS, Architect -	*Florence.*
1849	IL SIGNOR ANTOLINI, Architect, Professor of Architecture at the Academy - -	*Bologna.*
1844	IL CAVALIERE GIO. PIETRO CAMPANA -	*Rome.*
1842	IL CAVALIERE CLEMENTE FOLCHI, Architect, Vice-President of the Academy of St. Luke	
1848	IL SIGNOR BONUCCI - -	*Naples.*
1839	(D) THE DUKE OF SERRADIFALCO - -	*Sicily.*
1840	RAFFAELLE POLITI - -	*Girgenti.*
	MEXICO:—	
1853	IL SIGNOR CAVALARI -	*Mexico.*
1851	EL SENOR LORENZO HIDALGA, Professor of Architecture in the Military College -	
	RUSSIA:—	
1836	ALEXANDER BRULLOFF, Architect, Professor of the Academy of Fine Arts -	*St. Petersburg.*
	SWEDEN:—	
1855	MONSIEUR AXEL NYSTROM, Architect -	*Stockholm.*
	TURKEY:—	
1840	(D) GASPARO FOSSATI, Architect to the Russian Embassy	*Constantinople.*
	UNITED STATES OF AMERICA:—	
1842	FREDERICK DIAPER, Architect - -	*New York.*
1853	GEORGE SNELL, Architect - -	*Boston.*

ASSOCIATES.

ELECTED.

1851 Arthur Allom, 25, King Street, Covent Garden.
1857 Charles B. Arding, 23, Bedford Row.
1839 Addington Artis, 19, Warwick Street, Golden Square.
1846 A. J. Baker, 13, Porchester Terrace North.
1847 Robert R. Banks, 27, Sackville Street, Piccadilly.
1860 William Swinden Barber, Hanover Chambers, 12, Buckingham St., Adelphi.
1858 William G. Bartleet, Pinner's Hall, Old Broad Street, and Brentwood, Essex.
1849 R. C. Baxter, 21, Abchurch Lane, City.
1845 William Beck, 33, Finsbury Circus.
1858 Henry Blandford, Maidstone, Kent.
1857 E. Blatchley, 23, Berners Street.
1860 R. K. Blessley, 8, Furnival's Inn.
1861 W. J. Bodman, East Dean, Hampshire.
1858 T. A. Britton, 4, Hamilton Street, Camden Town.
1839 John Henry Browne, Holland Estate Office, Addison Road, Kensington.
1847 E. Browning, Stamford, Lincolnshire.
1855 Edward George Bruton, 14, Beaumont Street, Oxford.
1861 C. Buckeridge, 86, High Street, Oxford.
1838 William A. Buckley, 5, Orme Square, Bayswater.
1860 Hartley W. Burgess, 16, Walbrook, City.
1841 George Adam Burn, 9B, New Broad Street, City.
1849 Henry H. Burnell, 16, Bouverie Street, Fleet Street.
1835 Alfred Burton, St. Leonard's-on-Sea.
1860 H. M. Burton, 6, Spring Gardens, Charing Cross.
1854 Silvester C. Capes, 3, Furnival's Inn.
1856 Arthur Cates, 7A, Whitehall Yard.
1851 Francis Chambers, 27, Queen Street, Cheapside.
1857 J. T. Christopher, 10, Cannon Street, City.
1855 Thomas C. Clarke, 137, Leadenhall Street.
1860 Frederick Pepys Cockerell, Carlton Chambers, 8, Regent Street.
1853 William G. Coldwell, 6, Huntingdon Street, Thornhill Square, Islington.
1859 H. H. Collins, 61, Torrington Square.
1859 John S. Constable, Felstead, Essex.
1843 Robert Cooke, 5, Kendal Place, Vassall Road, Brixton.
1842 W. Corbett, 6, Raymond Buildings, Gray's Inn.
1844 J. E. Cox, 10, Hereford Street, Park Lane.
1859 Henry Dawson, 16, Finsbury Place South.
1860 L. De Ville, 36, Great Ormond Street.
1855 J. S. Donaldson, Bolton Gardens, Russell Square.
1835 George Enoch, 13, Tokenhouse Yard.
1854 Horace Field, 69, Lincoln's Inn Fields.
1860 B. Fletcher, 6, Oregon Terrace, Peckham Rye.
1846 Richard Forster, 9, Warwick Crescent, Harrow Road.
1860 W. Fotheringham, 2, Queen's Terrace, Holloway.

ELECTED.

1851 Charles Fowler, Jun., 12, Furnival's Inn.
1842 Francis E. H. Fowler, 32, Fleet Street.
1856 Henry R. Fricker, 106, Leman Street, Whitechapel.
1853 George Goldie, 9a, King Street, Downing Street.
1852 Alfred S. Goodridge, Bath.
1861 Theodore K. Green, 25, College Hill, E.C.
1856 W. J. Green, 36, Great Ormond Street.
1838 Frederick H. Groves, 8, Bridge Street, Westminster.
1860 Edward A. Grüning, Grove House, Highbury Grove.
1853 J. M. K. Hahn, 11, King's Road, Bedford Row.
1851 T. Harris, 30, Charles Street, Berkeley Square.
1860 B. A. C. Herring, 1, Dane's Inn, Strand.
1858 Gordon M. Hills, 12, John Street, Adelphi.
1848 Henry Hodge, 40, Leighton Grove, Gloucester Place, Kentish Town.
1859 Josiah Houle, 9, Guildford Street, Russell Square.
1858 Lewis H. Isaacs, 2, Verulam Buildings, Gray's Inn.
1861 W. G. Jackson, Freemantle, Southampton.
1854 Joseph James, 15, Furnival's Inn.
1861 R. J. Johnson, 10, Belgrave Street South, Pimlico.
1859 Frederick Judge, 42, Regent's Square.
1848 George Judge, Jun., 2, Great James Street, Bedford Row.
1860 E. Bassett Keeling, 32, Fleet Street.
1847 E. J. Kelly, 23, Thavies Inn.
1860 Frederick R. Kempson, St. Owen Street, Hereford.
1859 Charles J. Knight, 14, Argyll Street.
1853 J. T. Knowles, Jun., 1, Raymond Buildings, Gray's Inn.
1855 J. J. Laforest, 11, King's Road, Bedford Row.
1859 Charles Laws, 12, Doughty Street.
1859 Henry S. Legg, 6, South Square, Gray's Inn.
1858 William Lightly, 23, Bedford Row.
1861 Cæsar A. Long, 29, Union Street, Hackney Road.
1851 John M. Maclure, 15, Bedford Row.
1860 T. T. Mardon, 6, Great James Street, Bedford Row.
1852 William A. Mason, Goldlay House, Moulsham, Chelmsford, Essex.
1853 J. D. Mathews, 15, Belgrave Terrace, Lee, Blackheath.
1859 John Henry Metcalfe, 32, Argyll Street, Regent Street.
1859 F. Mew, 2, Great James Street, Bedford Row.
1839 Thomas Meyer, 10, Hereford Place, Caerleon Road, Newport, Monmouthshire.
1855 A. H. Morant, 2, Charlotte Row, Mansion House.
1858 Thomas Morris, Carlton Chambers, 12, Regent Street.
1851 James Murray, 25, Portman Street.
1861 W. Eden Nesfield, 15, Bedford Row.
1847 S. J. Nicholl, 126, Marylebone Road.
1856 D. C. Nichols, 33, Mecklenburgh Square.
1855 R. Nicholson, 7, Savile Terrace, Halifax, Yorkshire.
1861 William Oakley, 23, Albert Road, Regent's Park.

ELECTED

1849 Harry Oliver, 39, Gower Street, Bedford Square.
1860 John Wornham Penfold, 2, Charlotte Row, Mansion House.
1860 Charles John Phipps, 5, Paragon Buildings, Bath.
1849 R. P. Pope, 21, Bedford Row.
1845 N. T. Randall, 28, Great Winchester Street, City.
1845 W. C. Reed, 64, Old Broad Street, City.
1854 T. M. Rickman, 25, Keppel Street, Russell Square.
1858 Frederick J. Robinson, 22, Sackville Street, Piccadilly.
1860 Edward R. Robson, 18, Adam Street, Adelphi; and Durham.
1852 William Roe, 94, Lupus Street, Pimlico.
1850 T. H. Rushforth, Carlton Chambers, 12, Regent Street.
1853 Stephen Salter, Jun., 2, Great College Street, Westminster.
1856 George Saunders, 15, Hammersmith Terrace, Hammersmith.
1856 Ignatius C. Scoles, Beaumont, near Windsor.
1851 Edmund E. Scott, 8, Pavilion Buildings, Brighton.
1860 R. Norman Shaw, 8, Albion Road, St. John's Wood.
1855 Bright Smith, 15, Stratford Place, Oxford Street.
1854 C. Smith, Friar Street, Reading.
1856 T. Roger Smith, 57, Strand.
1861 Richard Phèné Spiers, Oxford.
1853 Edmund A. Spurr, East Barnet.
1861 Alfred P. Strong, 32, Keppel Street, Russell Square.
1853 Richard G. Suter, 3, Princes Place, Brighton.
1855 Edward W. Tarn, 58, Spring Street, Huddersfield.
1861 Robert G. Thomas, Adelaide, Australia.
1851 C. B. Thurston, F.S.A, 9, New Inn, Strand.
1854 S. W Tracy, Ipswich.
1860 Martin Underwood, Denbigh, North Wales.
1860 J. W. Walton, 18, Adam Street, Adelphi, and Durham.
1856 F. Warren, 6, Whitehall.
1851 M. Warton.
1848 R. Warton, Jun., Finchley.
1847 G. J. Wigley, 16, St. James's Terrace, Clarendon Road, Notting Hill.
1838 Herbert Williams, 52, Old Broad Street, City.
1856 R. L. Williams, Denbigh, North Wales.
1854 T. J. Willson, 126, Marylebone Road.
1856 F. R. Wilson, Bondgate, Alnwick, Northumberland.
1860 Herbert Winstanley, 2, Great James Street, Bedford Row.
1859 Richard C. B. Wood, 1, Trigon Terrace, Claylands Road, Kennington.
1860 John Young, 38, Lincoln's Inn Fields.

CONTRIBUTING VISITORS.

ELECTED	
1856	J. M. Blashfield, Esq., Stamford, Lincolnshire.
1856	J. G. Crace, Esq., 14, Wigmore Street.
1856	James W. Fraser, Esq., 8, Kensington Palace Gardens.
1855	William Hawkes, Esq., Edgbaston, Birmingham.
1858	G. C. Hedgeland, Esq., 13, York Place, Baker Street.
1855	David Q. Henriques, Esq., 10, Upper Wimpole Street.
1855	Peter N. Laurie, Esq., 6, Park Square West, Regent's Park.
1855	G. J. Morant, Esq., 35, Chester Terrace, Regent's Park.
1861	Sir Francis E. Scott, Bart., Great Barr Hall, near Birmingham.
1855	Henry Twining, Esq., Grove Lodge, Clapham Common.
1857	Joseph Wilks, Esq., 38, York Terrace, Regent's Park.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

REPORT OF THE COUNCIL

TO THE ANNUAL MEETING, MAY 6TH, 1861.

In reviewing the progress of the Institute during the past year, the Council are gratified to be able to report a continued and satisfactory advance. Their satisfaction is not, however, without alloy. They have had to lament the death of many of their members, and among them, some whose position and acquirements were such as to cause their loss to be felt in a far wider circle than that comprized by this Institute.

The last Report had but just been presented, when one not less endeared to us by his personal qualities than admired as one of the most brilliant ornaments of his profession, Sir Charles Barry, was suddenly taken from amongst us. The motives which induced the President to suggest a public funeral in Westminster Abbey, and a full account of that melancholy ceremony, with a biographical sketch by Mr. M. Digby Wyatt, have been already communicated to the members; we have now, therefore, only to add that it is proposed to erect a lasting memorial to his honour, by placing his statue in the New Palace of Westminster by public subscription.

Not less distinguished, though in another path, was the Earl of Aberdeen, one of your earliest Honorary Fellows. A member of the Society of Dilettanti, when a young man he visited Greece, and acquired and cultivated a taste for the arts and antiquities of that country. His work, "An Enquiry into the Principles of Beauty in Grecian Architecture" is characterized by a refined taste and extensive knowledge, and will cause his name to be always recollected as an enlightened patron of the Arts.

The decease of His Grace the Duke of Sutherland, K.G., who had been on the list of your Honorary Fellows, almost from the foundation of the Institute, has also taken place during the past year. Baron Bunsen, Honorary

and Corresponding Member, whom, from his long residence and numerous connections in this country, we are almost inclined to regard as our countryman, went to Paris, after distinguishing himself in the University of Göttingen, and thence to Rome, where he became secretary to the historian Niebühr, whom he ultimately succeeded as Prussian Minister, and became also his worthy successor as a learned archæologist. He profitted by his long residence in Rome, where he became President of the Archæological Society, to produce, in conjunction with Plattner, his valuable "Beschreibung der Stadt Roms," and some years later be brought out a work on the Christian Basilicas of Rome. His great work, "Egypt's Place in the World's History," was for the most part written during his residence in this country as Plenipotentiary from the Court of Prussia. Occupied, as he was the greater part of his life, in official situations, he, nevertheless found time for the production, besides those already mentioned, of several voluminous works on various subjects,—affording evidence at the same time of profound learning and indefatigable industry.

Samuel Ware, another of our late Honorary Fellows, was the author of a valuable and scientific work,—Tracts on Vaults and Arches. General Pasley, Honorary Member, the first Government Surveyor of Railways, was best known in connection with our profession as the author of a treatise on brickwork, and an excellent and elaborate work on Limes and Cements, the result of a long series of careful and valuable experiments. George Bailey, Fellow, for a long time one of your Honorary Secretaries, and first Curator of the Soane Museum, was indefatigable in his exertions in organizing this Institute at its first foundation. We have also to record the decease of James Blake, Fellow, and John Watson, Associate.

During the past year there has been an accession of thirty-five fellows, of these twenty-one have been received from the Class of Associates; one Honorary Fellow, two Honorary and Corresponding Members, and twenty-one Associates. Three Fellows and one Associate have been removed by death. Three Associates have retired. Three Honorary Fellows, one Honorary Member, and one Honorary and Corresponding Member have died.

It will be seen that a larger number of new Members has joined the Institute in the past year than at any time during the same period since its formation. It is not unreasonable to attribute this in some measure to the removal to the present premises, now fully adequate to the requirements of the Institute. The increased expenses are, therefore, more than met by the

increased subscriptions—rendering it unnecessary to sell out any of the funded stock, as was stated in the last report would probably be the case; on the contrary, the amount purchased during the year is £459. 10s. 9d. at a cost of £430. 10s., making a total of £2755. 5s., £3. per cent. Consols, in addition to £190. 7s. 5d., £3. per cent. Annuities. One important feature in this accession is the number of Country Members, most of the large provincial towns, as well as many others, being now represented; viz.—Alnwick, Bath, Birmingham, Brighton, Bristol, Burnley, Burslem, Cambridge, Canterbury, Chelmsford, Cheltenham, Coventry, Denbigh, Dudley, Durham, Edinburgh, Felstead, Gloucester, Halifax, Hereford, Huddersfield, Ipswich, Kidwelly, Leamington, Leeds, Llanrwst, Maidstone, Manchester, Monmouth, Newcastle-on-Tyne, Newport, Norwich, Oxford, Reading, St. Leonards, Sheffield, Southampton, Stamford, Torquay, Wimborne, and Winchester.*

In accordance with a suggestion made by some of the country members, the Council have decided to issue Certificates of Membership to all Fellows and Associates who may wish to possess them,—charging a small fee, sufficient to cover the cost of producing them.

It will have been already seen that no name has been placed on the list proposed by the Council for the office of President. Our present President reluctantly consented to accept office for one year only. The Council feel it impossible adequately to express their sense of his kindness, and consideration for the welfare of the Institute, in thus yielding his own personal feelings to the unanimous wish of the Members; nor can they fully convey their appreciation of the value of his distinguished services; but they have felt that they would not be justified in continuing to urge upon him, again to accept an office, involving as it does, a considerable amount of labour. They have therefore left it to the Members generally to suggest his successor.

The Committee appointed under the Act of Parliament for the Examination of District Surveyors have performed their functions by examining five Candidates, one of whom has received a certificate of competency.

In offering a sketch of the various subjects that have engaged the attention of the Institute during the past year, the Council wish it to be

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* The Institute now consists of 208 Fellows, 130 Associates, 8 Honorary Fellows, 14 Honorary Members, 80 Honorary and Corresponding Members, 11 Contributing Visitors, and 7 Students.

understood, that their constant endeavour has been, to carry out as fully as possible the wishes of the body that they represent. While they hope that they regard with a watchful eye all matters affecting the interests of the Profession, they by no means desire to engross the department of the initiative, but are both ready and anxious to receive suggestions and co-operation from the Members generally. Thus they have to acknowledge the assistance afforded them by a Committee appointed to arrange a scheme for Architectural Examination. This subject has engaged much of the attention of the Institute. The Committee appointed by the Council last year submitted a Scheme which was discussed at a Special General Meeting in June last: suggestions having been thrown out on that occasion that a more full expression of opinion on the part of the Members of the Profession practising in the country would be desirable, your Secretaries applied to all the Provincial Associations for their opinion, and from many of them answers were received, and after further discussion at a Special General Meeting on the 25th of January last, a Committee of Fellows and Associates was appointed, of which Mr. Ashpitel was nominated as chairman, and Mr. J. W. Papworth, hon. secretary, who have given the subject careful attention, and the result of their labours is embodied in a report now completed, which will be considered by the Council forthwith. The Library Committee has also been closely occupied in a careful examination of the books now in the possession of the Institute, and by the assistance of Mr. Wyatt Papworth, who was appointed Secretary to the Committee, has prepared a list of those works which they do not now possess, but which they consider ought to be included in a complete Architectural Library. This list has been circulated among the Members, in the hope that, by their liberality, many of the wants might be supplied—a wish which has been already to some extent responded to, and they have every reason to believe that a considerable addition will be thus made to the Collection. Other deficiencies will be supplied by purchase; and in a short time, it is confidently hoped that you will possess an Architectural Library second to none in the Kingdom. The Catalogue, which has long required correction, will then be reprinted.

Among the important works recently added, we may mention the admirable and elaborate work by C. R. Cockerell, President, on the Temple of Jupiter Panhellenius at Ægina, and of Apollo Epicurius at Bassæ, a work which has been long eagerly looked for, and which fully satisfies the very high expectations which had been formed of its merit. A report on the

Works of the Ganges Canal has been presented by the Secretary of State for India, through M. D. Wyatt, V.P., and we have continued to receive the valuable serials from France and Germany—viz: Arçhives de la Commission des Monumens Publics, from M. Fould; Revue General de l'Architecture et des Travaux Publics, by César Daly; and the Allgemeine Bauzeitung, by Prof. C. F. L. Förster.

The importance of maintaining a high standard of professional character cannot be over-rated; hardly less essential to the interests of the Profession is a uniformity of practice amongst its Members: but if they are not agreed among themselves, it is impossible for the public to recognize a system which in fact does not exist. The Members have gone on increasing in number for many years past, and it may now be fairly assumed that the Institute includes the great majority of the Profession. They are thus fully justified in laying down a code of regulations to which the Members will no doubt readily conform. In order to secure this result, the Professional Practice Committee, consisting of the Council, assisted by other Members of the Institute, have been occupied in collecting an expression of opinion from those best qualified by their extensive practice, and they are now in possession of a large amount of information for the assistance of the Members generally.

A communication has been received from one of the Provincial Architectural Associations proposing a closer alliance with them on the part of the Institute, which the Council will take into its careful consideration.

The preservation of the remains of Architectural Art throughout the country must always engage the attention of the Institute. The Council have endeavoured to save from destruction the old Town Hall of Hereford; but, unfortunately, without success: thus, another memorial of the skill and taste of our ancestors has been sacrificed to petty interests and ignorant indifference. The Guesten Hall adjoining the Cathedral of Worcester, being also threatened with mutilation, a memorial was presented to the Dean and Chapter; in consequence of which, Mr. Ewan Christian, Fellow, was called in to report on the condition of the building. He found it in a state of the most lamentable dilapidation, threatening destruction, unless measures were speedily adopted to arrest it. But, it appears that no steps have yet been taken with that object.

A memorial has also been forwarded to the Dean and Chapter of Lincoln, calling their attention to the manner in which the repairs and restorations are being carried on—which, it has been stated, are likely to

injure the building considerably. An answer has been received, but the Council are unable to state whether or not the works are continued in the same manner as heretofore.

The Bill for the Union of Benefices, which passed in the last session of Parliament, contemplating the ultimate removal of many of the City Churches, steps were taken, by a deputation to the Bishop of London, and by other means already reported to the Members, to procure the insertion of a clause to ensure the preservation of at least those of the greatest merit and interest. These efforts were successful with regard to four of the principal churches, but not so with regard to the towers and spires.

The works contemplated in the proposed covering of the area of the Royal Exchange have also engaged the attention of the Council, and the following resolution has been forwarded to the Gresham Committee:—"That the Royal Institute of British Architects, having been informed that certain works are contemplated in the interior area of the Royal Exchange, and being desirous that nothing may thereby be done detrimental to the architectural effect of that building, respectfully request the Gresham Committee not to sanction the carrying out of any additions or alterations whatever which may interfere with the interior architecture of the court, nor to construct any roof over the open area without the concurrence of the original architect."

The Bill for Artistic Copyright, mentioned in the last Report, did not become law; but another Bill has just been introduced by the Attorney-General, with the same object, in which buildings when once erected are especially *excepted from protection.* It will be the duty of the Artistic Copyright Committee to endeavour to procure the amendment of the Bill in this respect.

On the resignation, by Mr. Charles C. Nelson, of the office of Honorary Secretary—which he had held for ten years,—it was proposed to present him with a testimonial expressive of the sense the Members entertained of his valuable services and indefatigable attention to the interests of the Institute for so long a period. The proposal was very generally and cordially responded to. Mr. S. Smirke, R.A., consented to act as treasurer, by whom a Silver Vase and two Goblets were presented at a meeting of the subscribers.

The competitions invited for the Soane Medallion, and the other Medals of the Institute have not been satisfactory. For the former, only one set of drawings was received—which was not considered worthy to receive the prize,

—and no drawings or essays for the latter. It is to be regretted that the opportunities thus afforded are so much lost sight of by the younger Members of the Profession. A prize thus gained is an honourable distinction through life ; and the study employed in the endeavour cannot fail to be a great advantage to the Student. He discovers his deficiencies, and seeks to supply them by careful research; and thus, in the arrangement of a Design or the composition of an Essay, ideas which may have before existed in his mind as vague generalities become clear and accurate. He may derive advantage from failure; and, by comparing his own performances with those of a successful competitor may lay the foundation for future success.

It is gratifying, however, to be able to report that the competition among the Students has been more satisfactory. The designs and sketches possessed, all of them, considerable merit; and the Council, therefore, felt justified in giving two prizes in each Class. Mr. W. Paris gained the First Prize, for a design for a literary and scientific institution,—the Second being awarded to Mr. R. H. Carpenter. The successful competitor for the Monthly Sketches was Mr. E. J. Tarver,—Mr. W. Paris gaining the additional distinction of the Second Prize in this Class. This evidence of zeal and industry is deserving of great praise; and it may be hoped that by witnessing their success, others may be stimulated to follow their example. The Royal Medal was awarded to Mr. J. B. Lesueur, well known for his extensive works in connection with the Hotel de Ville at Paris, as well as for other important buildings. He attended the Meeting on the 22nd April, and acknowledged the honour conferred upon him, in terms highly complimentary to the Institute, regarding this Medal as a prize of a special character, to which none of the numerous rewards granted in other countries can be compared—awarded as it is, by those fully competent to form an opinion, and entirely free from the chance of favouritism.

It was announced last year that Mr. Vaughan, the successful competitor for the Soane Medallion of 1859, would this year claim the sum of £50, to which, on complying with certain conditions, he would be entitled. The drawings he has executed during the year since elapsed, have met with the approval of the Council, who consider that he has by his great industry fulfilled the required conditions. In his absence, his father received a cheque for the amount. It will be a subject for consideration whether the grant of this Travelling prize should not, for the future, be confined to members of the Institute, leaving the Soane Medallion open to all as before.

This year will be distinguished by the offering of several additional Prizes, the result of individual liberality. The President's prize is offered with a view to promote careful and elaborate drawing; that of Mr. Tite, to produce an evidence of the applicability of the Italian style to modern purposes; while Sir Francis Scott desires to prove the equal suitability of the Gothic of England and the Continent for similar purposes. Mr. Alexander's prize is calculated to promote the study of the ancient remains of military engineering in this country. The Council hails these various offers as evidences of zeal in the cultivation of our art, both within and without the pale of the Institute. Another important prize will probably before long be placed at the disposal of the Institute, as set forth in the following prospectus:—

"It has been resolved to do honour to the memory of the late Augustus Welby Pugin, for his services in the promotion of the true principles of Mediæval Architecture, and, in furtherance of this object, to solicit donations, and devote them to the Endowment of a Permanent Fund, to be entitled the "Pugin Travelling Fund," the interest arising therefrom to be awarded to an Architectural Student in such manner, and at such periods, as may hereafter be decided, and to be expended by the recipient within one year of the time of its allotment in travelling in the United Kingdom, and in examining and illustrating its Mediæval Architecture, Sculpture, and Painting. To the Studentship it is proposed to add a Medal. The Royal Institute of British Architects will be asked to become Trustees of the Fund."

The death of Mr. Bailey has been already alluded to. This caused a vacancy in the Curatorship of the Soane Museum, which was supplied in due course by the Council of the Royal Academy, who recommended Mr. Bonomi to the Trustees of the Museum as the one best qualified, among the numerous candidates, to fill the office. A requisition signed by eight fellows, was, upon this, forwarded to the Council, calling on them to summon a Special General Meeting of the members to take the subject into their consideration. At this meeting the following resolution was passed—

"That this meeting has every respect for the private character of Mr. Bonomi and for his high talent as an Artist and Archæologist, but does not consider there is evidence that he is qualified for the appointment of Curator to Sir John Soane's Museum under the terms of the Act of Parliament, as an English Architect who may have distinguished himself, or gained any academical prize."

This was communicated to the Council of the Royal Academy, as well as to the trustees of the Museum, and the appointment is still in abeyance.

The year 1862 is looked forward to as one of considerable interest to our profession in connexion with the proposed Exhibition. That of 1851 was confined to manufactures, and afforded opportunity for the display of various objects of construction, but only incidentally admitted of illustrations of taste and design. The approaching Exhibition on the contrary is intended to include a collection of objects of the different branches of the Fine Arts. At the head of the list stands Architecture, and it cannot fail to be an object of some anxiety to all interested in the honour of our profession that it should be there worthily represented. With this object, the Council have invited the co-operation of other architectural societies in London to form a general central committee, consisting (besides the Council of the Institute) of representatives from the Architectural Association, the Architectural Museum, the Architectural Exhibition, the Architectural Photographic Association, and the Ecclesiological Society; and this Committee is now actively engaged in endeavouring to ensure a full and complete representation of architecture at the Exhibition.

But the responsibility of showing that this country possesses a high degree of architectural talent rests with the members of the profession at large. It is to be hoped that all who have been engaged in the erection of buildings of importance will not fail to send full illustrations, so that foreign architects who will visit the collection, may see that the English School is behind no other, and that in excellence of design, and skill in construction, British architects are able to compete with those of any country in the world.

Allusion has been made in former reports to the employment of military engineers in the erection of ordinary buildings. There are, no doubt, instances to be met with, where those of other professions have evinced such an extraordinary aptitude for the study and practice of Architecture, as to justify a departure from the ordinary system. But the Exhibition buildings of 1862, to which this practice has been applied, cannot be regarded as forming one of these rare cases of exception. The designs have been prepared by a military engineer, and the whole business conducted and even contracts procured with such skilful secresy, that the public was surprized with a detailed description of the whole only on the eve of its commencement. It might appear invidious to express an opinion on this proceeding, or upon

the effect likely to be produced upon Foreign Architects by such a building as is proposed being shown to them, but the Council feel that a great wrong has been done to the profession, which in the competition for the government offices was acknowledged, by those most competent to form an opinion, to have risen above the occasion.

Among the public works in contemplation the proposed Thames Embankment must not be overlooked. This, after many years of consideration, seems now more likely to be carried out in connection with the plan adopted for the drainage of the metropolis, and if our expectations are not again disappointed, will, without interfering with the commercial character which has hitherto marked the banks of the Thames, acquire an aspect of architectural magnificence which may vie with the more favoured Capitals of the world.

The works in progress for the decoration of St. Paul's, alluded to in the last report, have been continued under the superintendence of Mr. Penrose, Fellow. The roofs of the transepts have been gilded, and that of the choir is about to be treated in a similar manner. The organ has been removed to the position originally designed by Sir Christopher Wren, and a new organ of great power put up in the south transept. The old colonnade, with the inscription to Sir C. Wren's memory, is designed to be re-erected at the north door. The works are proceeding, as far as funds admit, in the direction of a definite plan which embraces the use of mosaic, colour, marble, and gilding to a considerable extent, and includes twenty new windows filled with the richest glass, the others to be improved in their glazing, mainly with white glass effects.

In conclusion, the Council think they may with good reason congratulate the members of the Institute on the progress made during the past year. The number of meetings held since the last annual meeting has amounted to twenty-three, a larger number than that of any previous session for many years. The attendance of members, the subjects that have occupied their attention, and the state of the funds, have been causes for satisfaction; and the differences of opinion expressed during the various discussions have afforded evidence of the interest taken by members in the proceedings of a body which now fully and fairly represents the architectural profession, and are an additional proof of that vitality without which no society can ever hope to achieve success.

General Account of the Receipts and Disbursements from December 31st, 1859, to December 31st, 1860.

RECEIPTS.

1860.	£	s.	d.	£	s.	d.
To Balance in the hands of the Treasurer, December 31, 1859 ..	292	7	4			
— Ditto in the hands of the Librarian ditto.....	1	16	5			
				294	3	9
— Compositions of seven Fellows in lieu of annual payments....	257	5	0			
— Contribution of one Honorary Fellow (Earl de Grey and Ripon)	26	5	0			
				283	10	0
— Admission Fees of thirty-three Fellows..... 160 13 0						
— One Fellow overpaid 2 2 0						
	162	15	0			
— Subscriptions of Fellows	547	1	0			
— Arrears of Subscriptions of Fellows for previous years	30	9	0			
				740	5	0
— Admission Fees of twenty-one Associates.....	22	1	0			
— Subscriptions of Associates.....	263	11	0			
— Arrears of Subscriptions of Associates for previous years....	6	6	0			
				291	18	0
— Subscriptions and Entrance Fees of seven Students	....			14	14	0
— Ditto of Contributing Visitors	18	18	0			
— Arrears of Subscriptions of Contributing Visitors	2	2	0			
				21	0	0
— *Dividends on Stock : viz.*—						
Half Year's Dividend on £2256. 6*s.* 3*d.* { £3. per Cent. Consols (less Income Tax) }	32	0	3			
Ditto ditto on £2399. 6*s.* 0*d.* { (less Income Tax) }	34	9	10			
Half Year's Dividend on £190. 7*s.* 5*d.* { £3. per Cent. Reduced Annuities (less Tax) }	2	15	11			
Ditto ditto on £190. 7*s.* 5*d.* { Annuities (less Tax) }	2	14	9			
				72	0	9
— *Removal Fund :*						
Subscriptions received from Members	....			11	2	0
— *Earl de Grey's Portrait Fund :*						
Subscriptions received from Members	....			3	3	0
TOTAL				£1731	16	6

EXPENDITURE.

1860.	£	s.	d.	£	s.	d.
By Rent for One Half Year ending 31st December, 1860.....				250	0	0
— Taxes, and Insurance of the Books and Collection	....			10	17	7
— Fuel and Light	....			22	16	2
— Attendance	....			5	8	0
— Librarian's Salary	....			105	0	0
— Printing, Lithography, &c. and Reporter	....			258	1	6
— Stationery, Postage, Delivery of Letters, &c. Advertisements.	....			99	6	8
— Purchase of Books, &c., Bookbinding, Freight and Duty on Foreign Books.....	....			37	14	8
— Prize Medals	....			8	8	0
— Furniture, Fittings, and Occasional Repairs	....			47	1	2
— Tea, Coffee, &c. at Evening Meetings (including extra Attendance)	....			36	14	6
— Petty Disbursements	....			5	18	2
— *Purchase of Stock*, being Compositions of eight Fellows, *viz.*—						
One Fellow, compounded 30th December, 1859.....	36	15	0			
Seven Fellows do. in 1860.....	257	5	0			
And Contribution of the Earl de Grey and Ripon, Hon. Fellow	26	5	0			
				320	5	0
— *Removal Fund, viz :*—						
Legal Expences (Fees, &c. paid by Hon. Solicitor)	5	16	0			
J. Fowler, Cleaning Casts, &c.	7	8	0			
Johnston Brothers, Gas Fittings	36	5	0			
J. Hogarth, Cleaning Pictures, &c.	131	4	0			
Messrs. Caldecott, Furniture, &c.....	225	6	7			
P. Martens, Bookcases, Fittings, &c.	29	17	3			
				435	16	10
— Balance in the hands of the Treasurer, Dec. 31st, 1860	220	9	2			
Less Cheques drawn but not presented.....	138	7	9			
				82	1	5
— Balance in the hands of the Librarian, Dec 31st, 1860, *viz.*— By two Subscriptions of Associates, £6. 6*s.* and Petty Cash 10*d.*				6	6	10
				88	8	3
TOTAL				£1731	16	6

ASSETS.

	£.	s.	d.	£.	s.	d.
Cash in the hands of the Treasurer and of the Librarian, Jan. 31, 1860	.....			88	8	3
Amounts due from Members: viz.—						
Subscriptions of Fellows in arrear previous to January 1, 1860.....	1	1	0			
Subscriptions of Fellows for the year ending December 31, 1860.....	15	15	0			
Entrance Fees of Four Fellows for ditto ditto	18	18	0			
Subscriptions of Associates in arrear previous to January 1, 1860.....	12	12	0			
Subscriptions of Associates for the year ending December 31, 1860...	11	11	0			
Subscriptions of Contributing Visitors in arrear previous to Jan. 1, 1860	2	2	0			
Subscriptions of ditto ditto for the year ending December 31, 1860	6	6	0			
				68	5	0
				£156	13	3

LIABILITIES.

Rent, Salaries, and other current Expenses, from December 25th, 1860.

PROPERTY.

The Value of Copies of Transactions, and Reports on Competitions, on hand.
Books, Prints, Drawings, Models, Casts, Furniture, &c.

THE FUNDED STOCK of the Institute consists of £2595. 13*s.* 9*d.*, £3. per Cent. Consols.
(Travelling Fund) £190. 7*s.* 5*d.*, £3. per Cent. Reduced Annuities.
Thirty-six Shares in the Architectural Union Company, Limited, at £10. per Share = £360.

(*Signed*) T. HAYTER LEWIS, *Hon. Sec.*
J. J. SCOLES, *Fellow,*
JOHN THOS. CHRISTOPHER, *Associate,* } *Auditors.* *May 4th*, 1861.

Supplementary Balance Sheet to May 6th, 1861.

RECEIPTS.

1861.	£.	s.	d.
To Balance in the hands of the Treasurer and Librarian, Dec. 31st, 1860.	88	8	3
— Subscriptions and Entrance Fees of Members received from December 31st, 1860, to May 6th, 1861	678	11	0
— Composition of Four Members (London)	147	0	0
— Half Year's Dividend on £2595. 13*s.* 9*d.*, £3. per Cent. Consols (less Income Tax)	37	6	3
— Ditto on £190. 7*s.* 5*d.*, £3. per Cent. Reduced Annuities (less Income Tax)	2	14	9
— Donation to Library Fund	4	4	0
— Dividend on Thirty-six Shares in Architectural Union Company, Limited	18	0	0
	£976	4	3

EXPENDITURE.

1861.	£.	s.	d.
By Rent, Taxes, Salaries, and other current Expenses, from December 31st, 1860	280	3	3
— *Purchase of Stock, viz.:*— £159. 11*s.* 3*d.* £3. per Cent. Consols	147	0	0
— Soane Medallion Prize in 1858 (Thomas Vaughan) in addition to the Silver Medallion given to him in 1859	50	0	0
— Balance in the hands of Treasurer and Librarian	499	1	0
	£976	4	3

ASSETS.

	£.	s.	d.
Cash in the hands of the Treasurer and of the Librarian	499	1	0
Amount due from Members May 6th, 1861	184	13	0

LIABILITIES.

Rent, Taxes, Salaries, and other current Expenses, from March 25th, 1861.

PROPERTY.

The value of Copies of Transactions and Reports on Competitions on hand, Books, Drawings, Prints, Models, Casts, Furniture, &c.

THE FUNDED STOCK of the Institute consists of:—

£2755 5 0—£3. per cent. Consols.
190 7 5—£3. per cent. Reduced Annuities.

Thirty-six Shares in the Architectural Union Company, Limited, at £10. per Share = £360.

CONTRIBUTIONS

TO

THE COLLECTION AND THE LIBRARY OF THE INSTITUTE,

Between the 8th of May, 1860, *and the 6th of May*, 1861.

MISCELLANEOUS.

Donaldson, T. L., Fellow. Portions of Ancient Egyptian Marble, Stone, Mortar, Granite, &c., recently collected by himself.

Part, Mr. J. C. Sundry Plaster Casts from the late Mr. Cottingham's Museum.

Willoughby, Thomas, Fellow. Sir Christopher Wren, carved in Box-wood by Grinlin Gibbons; from the Collection of the late James Wyatt, Architect. Also a Piece of Flexible Sand Stone from Cawnpore, India.

Walton, J. W. Associate. A Fragment of Mosaic Pavement from Halicarnassus.

Whichcord, J. Fellow. Schedule of Prices for Artificers' Work in Tuscany. MS. foolscap, March, 1860.

DRAWINGS AND PRINTS.

Associate, An. "Portrait of a Fellow," from a Drawing made in 1828, by the late J. Hollins, A.R.A. Miniature, mounted and glazed. 1860.

Brandon, D. Fellow. The Buckinghamshire General Infirmary; Plans of Proposed New Buildings, and Plans of Present Buildings. David Brandon, F.S.A. Architect. Two Sheets, Lithographs. 25th April, 1860.

Botfield, B. Hon. Fellow. The West Window of the Church of St. Laurence, Ludlow. Photograph, coloured. 1860.

Clarke, G. Somers, Fellow. Four Mounted Photographs of No. 100, St. John Street Smithfield. G. Somers Clarke, Architect.—General View of 100, St. John Street, Smithfield. G. Somers Clarke, Architect. 1860. Photograph.

Duggin, Charles, Mr., New York. Plymouth Church, Brooklyn, L. I. Charles Duggin, Architect, through H. Garling, Fellow. Tinted Lithograph.

Francis, F. J., Fellow. North-West View of Warrington Church, Lancashire. —New Mansion, St. Leonard's Dale, Windsor. Photographs, 1860—Plan and Elevation of Schools, St. John's, Notting Hill. Lithograph.

Hansard, O. Fellow. Twenty-one Views of Florence, by Joseph Zocchi. Mounted Engravings (Nos. 9, 13, and 23 missing); and Two Engraved Portraits of Abraham Cowley, and Henry Tilson, Painter.—Thirty-two Plates published by the Society of Antiquaries. Folio. 1799 to 1815.—Description de la Chambre et Lit de Parade sur lequel la Corps de son Altesse Royale Anne Princesse Royale de la Grande Bretagne, &c. à été exposé pendant plusieurs jours en Fevrier, 1759. Par Monsieur De Lage et Mr. S. Fokke. Et la Convoie-Funebre de son Altesse Royale. Par P. C. La Farque et Simon Fokke. Folio. à la Haye (Hague), 1759, *in French and Dutch.*—Twelve Sets of Elevation and Details of the Front of the Banqueting House, Whitehall. Lithographs, with printed descriptions.

Incorporated Society, The. Thirty-two Sheets (numbered consecutively) of Details and General Arrangements of Country Churches and Fittings. Also, One Sheet of Church Fonts. Lithographs.

Klenze, Herr Leo von, Hon. and Cor. Member. Eglise Catholique de St. Denis Areopagite à Athenes. L. de Klenze. Photograph. 1860.

Lockyer, J. M. Fellow. Incised and Inlaid Mural Tablet, executed in Sicilian Marble and Scagliola (black and green) from the Designs of J. M. Lockyer, June, 1860. Photograph.

Mylne, R. W. Fellow. Portraits of Robert Mylne, F.R.S., &c., Architect, Engineer, and Surveyor. Born 1733, died 1811; and William C. Mylne, F.R.S., Architect and Civil Engineer. Engravings.

Papworth, J. W. Fellow. A Portion of the Bird's-eye Plan of Paris, showing the Buildings round the Louvre, Tuilleries, and Palais Royal, commenced 1734. Engraving. 1739.

Pullan, R. P. Fellow. Designs for Memorial Church at Constantinople, by by R. P. Pullan, Architect. Photographs from Drawings.—Designs for Lille Cathedral, by Evans and Pullan. Photographs.—Design for War Office, Whitehall; Front. R. P. Pullan, Architect.—Design for Foreign Office; Park Front. Photograph. R. P. Pullan, Architect.

Renwick, James, jun., Esq., and Rodrigue, William, Esq. Architects. View of the New Cathedral of New York. James Renwick, jun. and William Rodrigue, Architects. Large Lithographs.

Robins, E. C. Fellow. Coombe Cliffe House, Croydon, Surrey. E. C. Robins, Architect. Lithograph.—The Accepted Design for the Croydon Cemetery Chapels about to be erected. Photograph. E. C. Robins, Architect. 1 June, 1860.

Sibley, R. L. A Portrait of the late Thomas Telford, Civil Engineer. Engraving.

Stevens, J. H., Fellow. Burton-upon-Trent. Plan, Elevation, Section and Perspective View of Burton-upon-Trent Bridge, scale 20 ft. to an inch, measured and drawn by Mr. Nicholas Joyce. Drawing.

Willoughby, Thos. Fellow. Print of the Royal Academicians assembled in their Council Chamber. Engraving, with Key, framed and glazed.

Wilson, F. R. Associate. Contrasts —Gothic? or Classic? Two Photographs from Drawings by F. R. Wilson, Associate. Alnwick, 1860.

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Daly, C. Hon. and Cor. Member. Revue Générale de l'Architecture et des Travaux Publics. Par M. César Daly, Architecte. Nos. 3, 4, and 7 to 12, Vol. XVII, 1859, and Nos. 1 to 10 of Vol. XVIII, 1860. 4to. Paris, 1860.—L'Architecture Privée, au Dix-neuvième Siècle, sous Napoleon III. Nouvelle Maisons de Paris et des Environs. Par M. César Daly, Architecte du Gouvernement. Parts 1, 2, 3, 6, 7, 8, 9, 10. folio. Paris, 1860.

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Hope, A. J. B. Beresford, Esq., Honorary Fellow. The English Cathedral of the Nineteenth Century. By A. J. B. Beresford Hope, M.A., D.C.L. 8vo. London, 1861.

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Papworth, W., Fellow. Memoirs of the Life and Works of Sir Christopher Wren, with a brief View of the Progress of Architecture in England, &c. By James Elmes, M.R.I.A., Architect. 4to. London, 1823.

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Rowe, R. R., Fellow. Some Account of a late Tour in France, being a Lecture delivered by William Beumont, Esq., of Warrington. Pamphlet. 8vo. Newton, 1860.—Report of the Proceedings of the Congress of the Architectural Society, held at Cambridge on May 28, 29, 30, and 31. Printed from the "Cambridge Chronicle" of June 2, 1860. Pamphlet. 8vo.

Roberts, Henry, Fellow. Healthy Dwellings, and prevailing Sanitary Defects in the Homes of the Working Classes. By Henry Roberts, F.S.A. F.R.I.B.A. Pamphlet. 4to. London (no date).—The Progress and present Aspect of the Movement for Improving the Dwellings of the Working Classes. By Henry Roberts, F.S.A. Pamphlet. 4to. London, 1861.

Sibley, R. L., Fellow. A Description of the Cathedral Church of Ely, with some account of Conventual Buildings. By George Millers, M.A., Minor Canon. 8vo. London, 1807.—Essays on Architecture, by the Rev. T. Warton, Rev. J. Bentham, Captain Grose, and the Rev. J. Milner. 8vo. London, 1800.—A Letter from Athens addressed to a Friend in England. 8vo. London, 1812.

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Stevens, Henry, Esq., F.S.A. Plans of Public Buildings in course of Construction for the United States of America, under the direction of the Secretary of the Treasury. 39 parts, large folio, 1855 and 1856.—Specifications for ditto, 2 vols. 8vo. Washington, 1856.

Smith, Theophilus. Photographic Illustrations of the Architecture and Sculptured Details of Steetley Church, Derbyshire. By James Contencin, with Plans and Sections, measured and drawn by Theophilus Smith. 4to. Worksop, 1860.

Tite, Wm., M.P., Fellow. Remarks on the Union of Benefices Act. By Charles Hume, Rector of St. Michael's, Cornhill. London, 1860.

Twining, H., Contributing Visitor. Brief Programme of the Economic Museum. Pamphlets. 8vo. (no date).

Vaux, Calvert, Esq. Third Annual Report of the Board of Commissioners of the Central Park. Pamphlet. 8vo. New York, 1860.

Wiltshire Archæological Society (The). The Wiltshire Archæological and Natural History Magazine. No. 18, Vol. VI, Devizes, April, 1860; and No. 19, Vol. VII. Devizes, October, 1860.

Wilson. F. R., Associate. A Cursory Survey of the Churches and Church Buildings within the Archdeaconry of Lindisfarne: a Charge founded on the Reports of the Rural Deans. By R. Cox, M.A., Archdeacon. Pamphlet. 8vo. London, 1860.—Proceedings of the Berwickshire Naturalists' Club: the Annual Address delivered at Wooler on 29th September, 1859. Pamphlet. 8vo.—Proceedings of the Berwickshire Naturalists' Club. Pamphlet. 8vo. 1860.

Wyatt, M. Digby, V.P. The Art of Illuminating. Pamphlet. 4to. (no date).—Practical Geometry, or a New and Easy Method of Treating that Art, &c., translated from the French of Monsieur S. Le Clerc. Fourth Edition. 8vo. London, 1764.—Fires Improved: being a New Method of Building Chimneys so as to prevent their Smoaking, &c. Written in French by Monsieur Gauger; made English and improved by J. T. Desaugliers, M.A., F.R.S. By whom is added the Manner of making Coal Fires, as useful this new way, as the Wood Fires proposed by the French Author, &c. 8vo. London, 1715.

MEDALS AND PRIZES AWARDED.

ROYAL GOLD MEDAL.

1848. C. R. COCKERELL, R.A.
1849. CAV. L. CANINA, Hon. & Cor. Member.
1850. C. BARRY, Fellow, R.A.
1851. T. L. DONALDSON, Fellow.
1852. CHEV. LEO. von KLENZE, Hon. & Cor. Member.
1853. SIR R. SMIRKE, Hon. Fellow, R.A.
1854. PHILIP HARDWICK, Fellow, R.A.
1855. J. J. HITTORFF, Hon. & Cor. Member.
1856. WILLIAM TITE, Fellow, M.P.
1857. OWEN JONES, Fellow.
1858. AUGUST STÜLER, Hon. & Cor. Member.
1859. GEORGE GILBERT SCOTT, Fellow, A.R.A.
1860. SYDNEY SMIRKE, Fellow, R.A.
1861. J. B. LESUEUR, Hon. & Cor. Member.

INSTITUTE MEDAL.

1836. Geo. Godwin, Associate.
1838. W. W. Pocock, Associate.
1840. Herr Hallmann.
1841. E. Hall.
1842. Anonymous, with motto—(Alas! what perils do environ.)
1843. E. Chamberlain.
1845. S. J. Nicholl, Student.
1846. Chevalier Beuth.
1846. T. Worthington.
1847. J. W. Papworth, Fellow.
1848. H. B. Garling, Associate.
1849. Wyatt Papworth.
1853. J. H. Chamberlain.
1853. C. T. Hargrave.
1854. E. L. Tarbuck.
1855. W. P. Griffith, Fellow.
1855. W. Salzenberg.
1856. T. A. Britton.
1857. E. W. Tarn, Associate.
1858. J. Blake (with £5. 5s.)
1859. G. Wightwick.
1859. E. Hughes (with £5. 5s.)

SOANE MEDALLION.

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1838. S. Sharp, Associate.
1839. S. Sharp, Associate. (The Medallion with a gold rim.)
1842. J. W. Papworth, Associate.
1843. A. Johnson, Student.
1848. J. Maclaren.
1856. L. R. Roberts.
1857. W. J. Green, Associate.
1858. D. Paton Low.
1859. T. Vaughan, and £50. in 1861.

MEDAL OF MERIT.

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1838. G. E. Laing, Architect.
1839. W. W. Pocock, Associate.
1839. E. Hall.
1843. J. W. Papworth, Associate.
1846. S. J. Nicholl, Student.
1846. J. F. Wadmore.
1847. J. Bell, Associate.
1852. J. T. Knowles, Jun.
1853. W. G. Coldwell, Associate.
1853. J. T. Knowles, Jun.
1854. T. A. Britton, Student.
1854. J. G. Elgood.
1854. C. F. Hayward. (With an honourable addition.)
1856. T. C. Sorby.
1856. J. Blake.
1857. A. H. Parken.
1858. H. Fuller.
1858. H. R. Kempson.
1860. . . . . .

PRIZE BOOKS.

1839. W. Clerihew, Associate.
1843. A. Johnson, Student.
1844. A. J. Baker, ditto.
1844. W. W. Deane, ditto.
1845. G. Judge, Jun. ditto.
1845. W. W. Deane, ditto.
1846. G. Judge, Jun. ditto.
1846. S. J. Nicholl, ditto.
1847. W. Boutcher, ditto.
1847. S. J. Nicholl, ditto.
1848. Bright Smith, ditto.
1848. T. Hill, ditto.
1849. T. Hill, ditto.
1850. Bright Smith, ditto.
1852. B. Fletcher, ditto.
1852. W. Lightly, ditto.
1852. W. Lightly, ditto.
1852. T. C. Tarring, ditto.
1853. T. A. Britton, ditto.
1854. F. T. Gompertz.
1855. C. N. Beazley, ditto.
1857. M. Underwood, ditto.
1859. W. T. Sams, ditto.
1861. W. Paris.
1861. E. J. Tarver.
1861. R. H. Carpenter, Student.

PROCEEDINGS AT THE ORDINARY, EXTRA-ORDINARY, AND SPECIAL GENERAL MEETINGS, PAPERS READ, &c.

After the 7th of May, 1860, *to the 22nd of April*, 1861.

16*th May*, 1860.—*Extra-ordinary General Meeting.* A Letter was read from the Dean of Westminster, granting permission to inter Sir Charles Barry, Fellow, in Westminster Abbey.

Thanks were Voted to the Dean of Westminster.

A Resolution was passed recording the profound sympathy of the Royal Institute of British Architects with the family of their late lamented colleague.

21*st May*.—"A Necrological Memoir of the late Sir Charles Barry." By M. Digby Wyatt, V.P.

4*th June*.—"On the Origin and Development of the use of Crypts in Christian Churches, from the Earliest Period." By Arthur Ashpitel, Fellow, F.S.A.

A letter from Lady Barry was read, acknowledging, on behalf of herself and family, the Resolution of the Extra-ordinary General Meeting of 16th May.

18*th June*.—*Closing Ordinary Meeting of the Session*.—"On the Use of Granite." By Sir Gardner Wilkinson, F.R.S., Honorary Member.

"On Illuminated Manuscripts as Illustrative of the History of the Arts of Design." By M. Digby Wyatt, V.P.

A Memorial to the Dean and Chapter of Worcester, against the threatened destruction of the Guesten Hall, adjoining the Cathedral, was read, and afterwards signed by many members present.

The Right Honourable the Earl De Grey and Ripon was unanimously elected an Honorary Fellow.

25*th June*.—*Special General Meeting.* The subject of Architectural Examination was considered, and the following Resolution passed:—"That it is desirable to afford an opportunity for a Voluntary Professional Examination."

2*nd July*.—*Special General Meeting.* The subject of Architectural Examination, adjourned from the last meeting, was again considered, and the Meeting was adjourned to the second Monday in November.

5*th November*.—*Opening Meeting of the Session*, 1860-61. "Recollections of Sicily." By Sydney Smirke, R.A., Fellow.

A Letter, from W. Tite, Fellow, was read, offering a Prize of £10 10s. annually for the best set of Sketches or Suggestions in the Italian Style of Architecture, adapted to modern wants.

The Special General Meeting on the question of Architectural Examination was adjourned from the 12th of November to the 10th of December.

19*th November*.—"On Architectural Drawing." By W. Burges, Fellow.

3*rd December*.—"On Church and Conventual Arrangement." By the Rev. C. Mackenzie Walcott, M.A.

The Hon. Sec. for Foreign Correspondence announced the decease of Chevalier Bunsen, Hon. and Cor. Member, and gave a slight sketch of his life.

It was Resolved that the discussion on the question of Architectural Examination be postponed till such time as the Council may think proper.

17*th December.*—"On Acoustics." By T. Roger Smith, Associate.

The decease of the Right Honourable the Earl of Aberdeen, and of Samuel Ware, Honorary Fellows, was announced.

7*th January*, 1861.—"On the Churches of Le Puy en Vélay and of Auvergne." By G. E. Street, Fellow.

A Letter was read from the Dean of Lincoln, relative to the works now being carried on in the Cathedral of that City.

The decease of George Bailey, Fellow, was announced by the Chairman, M. Digby Wyatt, V.P., who gave a sketch of his life.

14*th January.*—*Special General Meeting.* The subject of Architectural Examination was considered, and the following Resolution passed—"That the Council be instructed to proceed towards the preparation of a Curriculum and Bye-Laws, and be recommended to appoint a Committee to this end to report to a General Meeting."

21*st January*,—"On the Transverse Strength of Bricks," and "On Expansion of Brickwork in a Furnace Chimney." By W. Hawkes, C.E., Contributing Visitor.

A fragment of Mosaic from Torcello, specimens of Mosaic glass discs from Murano, and a machine for cutting the discs, were exhibited by F. C. Penrose, H.S.F.C.

Specimens of painted flock papers, of bitumenized pipes, and of a new material in imitation of marble, porphyry, &c., were also exhibited.

28*th January.*—*Extra-ordinary General Meeting.* A Letter from the Town Clerk of Hereford was read, stating that the Town Council regret that they could not comply with the wish expressed in a Letter from the Council of the Royal Institute of British Architects that the Old Town Hall and Market House in that City should be restored.

W. Tite, Fellow, gave a history of the various processes for the Preservation of Stone. A Discussion thereon ensued, which was adjourned to the next meeting.

4*th February.*—Adjourned discussion on the preservation of stone.

The decease of John Watson, Associate, was announced.

11*th February.*—*Extra-ordinary Meeting.* Adjourned discussion on the preservation of stone.

It was resolved—"That the Council be requested to memorialize Her Majesty's Government urging that a joint Committee of Architects, Engineers, Geologists, Chemists or other competent persons be appointed to enquire into the various proposed modes of preserving stone from decay; with special reference to the present condition, causes and extent of decay of the stones of the Houses of Parliament, and that, in the meanwhile, no further large application of washes to the exterior of the building be permitted.

18*th February.*—"Description of Mons. Mariette's Excavations at Gizeh and Saccara."

"Some Observations on the Domestic Architecture of the Ancient Egyptians, as existing among the present Arabs."

"An Account of Catacombs at Alexandria recently discovered."

Being notes made during a recent visit. By T. L. Donaldson, V.P.

Antique Egyptian Fragments of Marble, Stone, Mortar, &c., collected by T. L. Donaldson, were presented by him to the Institute.

25*th February.*—*Special General Meeting.* In conformity with the recommendation of the Council, taken into consideration by the meeting, it was unanimously resolved humbly to submit to Her Majesty's gracious consideration that the Royal Gold Medal for the year 1860 should be awarded to Mons. J. B. Lesueur, Architect, Member of the Institût, Paris; Honorary and Corresponding Member.

The report of the Council on the Drawings received in competition was read and agreed to.

The recommendation of the Council with reference to the Royal and other Medals, and the Prizes offered by the President, by Mr. Tite, and by Mr. Alexander, Fellows, for the year 1861, was read and agreed to.

4th March.—"Notes on the Romanesque Architecture of the South of France." By J. B. Waring, Fellow.

T. L. Donaldson, V.P., called attention to two antique Greek vases from Alexandria.

The Chairman reported the result of an interview with the Hon. W. Cowper, Her Majesty's Chief Commissioner of Works, on the subject of the Preservation of the Stone Work at the New Houses of Parliament, and that no further experiments would be tried upon the building pending the scientific enquiry.

Her Majesty's sanction to the award of the Royal Medal for 1860 was announced.

18th March.—"On Saracenic Architecture." By Sir Gardner Wilkinson, F.R.S., Honorary Member.

The decease of the Duke of Sutherland, K.G., Honorary Fellow, was announced.

25th March.—Special General Meeting, called in conformity with a Requisition signed by Eight Fellows.

The appointment of Mr. Joseph Bonomi as Curator of the Soane Museum was considered, and,

It was resolved—"That there was not evidence that he was qualified for the appointment, under the terms of the Act of Parliament."

8th April.—"On the Architectural History of Chichester Cathedral, and the Fall of the Tower." By Professor Willis, M.A., F.R.S., Honorary Member.

The offer of a Prize of Ten Guineas annually for five years by Sir Francis E. Scott, Bart. was announced, for the best set of Sketches for a building devoted to Civic or Domestic purposes, designed on Mediæval principles.

A Resolution was passed deprecating any covering over the internal area of the Royal Exchange without the concurrence of the original Architect.

22nd April.—"On the Architectural Accessories of Monumental Sculpture." By F. Pepys Cockerell, Associate.

The death of Lieut.-General Sir C. W. Pasley, K.C.B., Honorary Member, was announced.

The Royal Gold Medal was presented by C. R. Cockerell, R.A., President, to Mons. J. B. Lesueur, of Paris;* the Students' Prizes awarded during the session to Mr. W. Paris, Mr. E. J. Tarver, and Mr. R. H. Carpenter, and a cheque for £50. Soane Medallion 1859, travelling fund, to Mr. Vaughan on behalf of his son, were also presented. Honourable Mention was made of the Sketches by Mr. William Hallam, Student.

Original Drawings, and other Illustrations of the Papers read, were exhibited at the Evening Meetings.

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* *Réponse de* M. LESUEUR *en recevant la Medaille de sa Majesté la Réine.*

M. Lesueur, après s'être excusé de ne pouvoir répondre dans la même langue s'exprime ainsi:

22 *Avril*, 1861.

Monsieur le President, Messieurs et chers Confrères,

Je suis on ne peut plus flatté de l'honneur insigne que vous me faites, et j'en suis d'autant plus fier que je reçois ici une distinction toute speciale.

Il ne s'agit point en effet d'une de ces decorations décernées et souvent même prodiguées, par des hommes tres-haut placés, sans doute et d'un mérite généralement incontestable, mais n'ayant pas toujours l'aptitude necessaire pour juger les œuvres d'art.

Votre Institût, au contraire, possédant toutes les connaissances necessaires pour bien apprecier les productions monumentales, son suffrage acquiert une valeur incomparable que j'apprecie avec la conscience du cœur, et que me remplit de la plus vive reconnaissance.

On a dit que les arts étaient cosmopolites. Grace à la facilité des communications, cette verité deviendra de jour en jour plus évidente, et les artistes de tous les pays ne formeront peut être bientot qu'une seule et immence Academy.

Vivant dans une époque d'éclectisme, de tatonnements, nous avons une grande tâche à remplir; celle de donner à l'art le caractère propre à notre siècle. Cette tâche est difficile pourtant ne nous décourageons point. De nombreuses publications nous font mieux connaître les monuments de tous les pays, de tous les ages; ce sont de précieux documents que nos devanciers ne possedaient que tres imparfaitement.

Espèrons que l'etude comparative de ces féconds elements produira enfin, non pas une architecture nouvelle, ce que n'est qu'une utopie, mais une nouvelle nuance de style que sera le cachet de l'architecture de la seconde moitié du XIX^{e} siècle.

Londres et Paris étant non seulement les deux plus grandes capitales de l'Europe, mais encore les capitales les plus voisines, c'est à nous qu'il appartient de donner l'impulsion; et je suis fier d'être un des anneaux de la chaine que doit unir indissolublement les deux pays.

Je conserverai précieusement le souvenir de ce jour qui consacre entre nous des relations plus intimes, que ne peuvent que s'étendre et se généraliser dans l'avenir; quant à moi, Messieurs et chers confrères, j'y concourrai de tout cœur, mue par le sentiment de la plus vive gratitude.

SUBJECTS FOR MEDALS AND PRIZES, 1861.

At the Special General Meeting, held on Monday, 25th February, 1861,

The following Recommendation of the Council with reference to the ROYAL MEDAL for the year 1861, was read and agreed to:—

Her Majesty having been pleased to grant her gracious permission that the Royal Medal be conferred on such distinguished Architect or Man of Science, of any Country, as may have designed or executed any building of high merit, or produced a work tending to promote or facilitate the knowledge of Architecture, or the various branches of Science connected therewith;—

That the Council do proceed in January, 1862, to take into consideration the appropriation of the Royal Medal.

The following Recommendations of the Council were also read and agreed to:—

INSTITUTE MEDAL.

That the Silver Medal of the Institute be awarded to the author of the best Essay on either of the following subjects:—

1st. The proper application of wrought and cast iron, constructively and artistically.

2nd. The application of timber work in England, constructively and artistically, from the year 1400 to the present time.

3rd. The introduction of Italian Architecture into England.

4th. The principles of the application of Iron Work in the construction of Floors and Roofs, illustrated by examples.

* The Essays to be written *very legibly* on alternate pages, and to be accompanied by suitable illustrations.

That the Silver Medal of the Institute, with Five Guineas, be also awarded for the best illustrations, geometrically drawn from actual measurement, (*with dimensions figured*, both on the drawings shewing the general arrangements, and on the details,) together with descriptive particulars, of an Abbey Gateway, a Bridge, or other Mediæval building in the United Kingdom, hitherto unpublished in that manner.

The drawings to consist of at least one plan, an elevation, and a section, drawn to the scale of $\frac{1}{8}$ of an inch to the foot, with details to a larger scale. The Elevations to be in line, or black lined only, and the plans and sections to be tinted in sepia only. Perspective drawings may be also sent, and may be either etched in, or tinted in sepia, or Indian ink. The jointing of the masonry, if any, to be particularly marked.

** These Medals are open to all Members of the Profession, without limitation as to age.

SOANE MEDALLION.

That the Soane Medallion be awarded for the best design, well illustrated by a sufficient number of drawings, for:—

A Museum of Sculpture and Pictures, Ancient and Modern, with Lecture Room to hold 500 persons, and Library to hold 5000 Volumes.

The drawings to consist of plans, sections, and elevations, drawn to the scale of $\frac{1}{8}$ of an inch to the foot, together with a bird's-eye view of the whole arrangement, and a block plan. Each of the two latter drawings to be to such a scale as a sheet of double elephant paper will admit. The plans and sections to be tinted in sepia only, and the elevations to be in line, or black lined only. Perspective drawings may also be sent, and they may be tinted or etched.

The successful Competitor, if he go abroad within three years after receiving the Medallion, will be entitled to the sum of £ 50. at the end of one year's absence, on sending satisfactory evidence of his progress and his studies.

*** The competition for the Soane Medallion is open to all Members of the Profession under the age of thirty years.

THE PRESIDENT'S PRIZE.

That the Prize of Ten Guineas offered by the President, be awarded to the author of the most approved set of Architectural Drawings, consisting of plan, elevation, and section, executed in the best manner, in colour, and shaded, and occupying not less than a sheet of Imperial paper. The scale to be $\frac{1}{8}$ of an inch to the foot. The subject to be a Building of an admired example, or of original design, such as a Chapel, a Pleasure House for a Garden, a Park Gate Entrance Lodge, a moderate sized Villa, or a small Market House and room above.

The plan of Ground Floor to be in dark Indian ink, with plinth, steps, railings, pavings in slabs or mosaics, flooring or parquet, expressed thereon, internally; and externally, the terrace or parapets, grass or gravel approach, to the extent of 10 or 15 feet, to be expressed, slightly coloured.

The elevation to be shaded and coloured, in courses of stone or marble, rustics or ashlar; the architectural sculpture, vegetable or animal; the slates or tiles; the profiles, mouldings, enrichments; and landscape; to be carefully indicated.

The section to be in dark Indian ink—interior and exterior—and construction (where possible) to be indicated and expressed.

The whole to be a fair set of drawings in the best manner.

**** The above Prize to be open to all Students, whether of the Institute or not.

That a Prize of Books be given by the Institute to the author of the design that may be considered the second in merit.

MR. TITE'S PRIZE.

That a Prize of Ten Guineas, announced at the Ordinary General Meeting, held on the 5th November, 1860, as having been offered by Mr. Tite, M.P. F.R.S. Fellow, be awarded to the author of the best set of Sketches or Suggestions, in the Italian style of Architecture, for Public Buildings adapted to Modern wants, *e.g.* Churches, Town Halls, Railway Stations, Public Offices, &c. in England.

The Sketches may be either in outline, or coloured, or tinted only, and they may be drawn either in perspective, or geometrically. If in perspective they are to be of the size which a sheet of imperial paper will admit. If drawn geometrically, they must be to the scale of $\frac{1}{8}$ of an inch to the foot.

A Plan, tinted in sepia, of the Principal Floor of the Building, drawn to a scale of $\frac{1}{8}$ of an inch to the foot, is to accompany each set of Sketches.

† The competition is open to all Associates and Students of the Institute. Each competitor is to send in not less than two, and not more than three, sets of Sketches.

Sir FRANCIS E. SCOTT's PRIZE.

That a Prize of Ten Guineas, offered annually by Sir Francis E. Scott, Bart., for the term of five years, be awarded to the author of the best set of Sketches for a Building of moderate dimensions, devoted to Civic or Domestic purposes, in accordance—throughout—with the advance of modern civilization, and designed in harmony with the constructional and ornamental principles that prevailed in the Architecture of England, France, Germany and Flanders, from 1200 to 1500, and in that of Italy from 1250 to 1400.

The Sketches may be either in outline, or coloured, or tinted only, and they may be drawn either in perspective, or geometrically. If in perspective, they are to be of the size which a sheet of imperial paper will admit. If drawn geometrically, they must be to the scale of $\frac{1}{8}$ of an inch to the foot.

A Plan, tinted in sepia, of the Principal Floor of the Building, drawn to the scale of $\frac{1}{8}$ of an inch to the foot, is to accompany each set of Sketches; and details of some part of the Furniture, Fittings, Stone-work, Metal-work, &c. are to be sent in drawn to scale in perspective, and finished in any manner chosen by the Candidate.

†† The competition is open to all Associates and Students of the Institute. Each competitor is to send in one set, only, of Sketches.

Mr. ALEXANDER'S PRIZE.

That a Prize of Ten Guineas, offered by G. Alexander, Fellow, will be given for the best Essay on the four Ancient Camps near Swindon, Wiltshire, viz. Blunsdon, Uffington, Liddington and Barbury, shewing how, without injury to the Ancient Remains, works of a temporary character might be added, to render them available for defence by Rifle Volunteers and others; taking advantage of the resources of modern science, the railway, telegraphs, &c., and of the large engineering works at Swindon.

The Essay to be accompanied by a Plan and Section (drawn to the same scale) of one at least of the old camps, and Diagrams and Sketches of the proposed works.

††† This competition is open to all Members of the Profession.

STUDENTS' PRIZE.

(For Students of the Institute only.)

That the subject of the Design for the Students' Prize in Books for the year 1861 be:—

"A Dispensary, suited for a Manufacturing Town."

The drawings to be executed to the scale of $\frac{1}{8}$ of an inch to the foot; the plans and sections to be tinted in sepia, and the elevation to be in outline, etched or tinted in sepia. Perspective drawings are not necessarily required, but may be sent, and be in outline etched, or tinted in sepia.

STUDENTS' MONTHLY SKETCHES.

(By Students of the Institute only.)

The following subjects have been selected for the Sketches for 1861, and they may be taken in any order, attention only being requested to their being forwarded to the Honorary Secretaries at as regular intervals as possible.

List of Subjects:—

A Base of a Column seen from above.	Mouldings (with Sections).
Canopy.	Pinnacle.
Corbel.	Scroll-work in Stone or Plaster.
Acanthus Leaf.	Scroll-work in Iron or Wood.
Cross.	Capital, moulded, seen from below.
Cornice.	Ditto, foliated.

The Sketches to be made from actual buildings, or from casts, or other examples in relief.

Any Student may send a Study or Studies from the Human Figure in place of either or any of the above subjects, provided only that the said Studies do not exceed in number one half of his Architectural Sketches.

All the Sketches to be at least as large as a half sheet of Imperial will admit.

They may be in outline only, or etched in, coloured, or tinted.

DIRECTIONS FOR COMPETITORS.

Each Essay and set of Drawings is to be distinguished *only* by a mark or motto, *without the name of the author attached;* but it is to be accompanied by a Letter, sealed with a *blank seal*, and having on the outside the same mark or motto as that attached to the Essay or Drawings, and enclosing his name, with an address to which a communication may be sent. The packet directed, "*To the Honorary Secretaries of the Royal Institute of British Architects*," and marked *Essay for Medal* (or) *Drawings for Medal (Motto)*, is to be delivered at the Rooms of the Institute on or before the 31st of December, 1861. Only the envelopes containing the names of the successful competitors will be opened.

Should none of the Essays, Drawings, Subjects, or Buildings respectively, be deemed by the Institute of sufficient merit and importance to deserve the distinction of the Premium offered in each case, they reserve to themselves the right of awarding such other Premium in lieu thereof as they may deem fit, or of withholding it altogether; and if the best Essay or Drawings should be by a Candidate who has been successful on a former occasion, they reserve the power of adjudging such other reward as they may think fit, and of awarding the Medals to the second in merit. The Essays, and Illustrations, to which the Institute Medals are awarded, become the property of the Institute, to be published by them if thought fit. In case the Essays are not published within six months after the award of the Medals, the authors will be at liberty to publish them. The Drawings for the Soane Medallion will be returned to all the candidates, on application; to the unsuccessful after the adjudication, and to the successful after the presentation of the Medal.

*** *Strict Compliance with all the above Directions is required.*

Copies of this Paper, or any further information, may be had on application to the Honorary Secretaries, by letter pre-paid.

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